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DISSERTATION

IDENTIFYING THE LIMITS OF AN INTEGRATED TRAINING ENVIRONMENT USING HUMAN ABILITIES AND AFFORDANCE THEORY

by

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13. ABSTRACT (maximum 200 words)

This research investigated the development and use of an analytical assessment methodology anchored in systems engineering principles, affordance theory, and human abilities, to measure the potential of integrated training environments (ITEs) to effectively support training. Empirical investigation of ITEs is costly, lacks formal guidance, and is therefore often unreliable. Ad hoc studies, commissioned by individual organizations, constitute the current state of Army ITE evaluation. These assessments are often entirely based on subject matter expert judgment through surveys, which produce results that are linked indirectly and loosely to the ITEs. What is required is a repeatable, inexpensive, analytical approach to ITE assessment that bounds the potential of a given system to the support it provides to the deliberate practice of specific tasks. The results of this research include the development and use of the integrated training environment assessment methodology (ITEAM). ITEAM was used to evaluate the ability of several ITEs to support the deliberate practice of specific tasks during training. The dissertation shows that ITEAM consistently predicted where training was supported by an ITE and generally how well. ITEAM is offered as a tool to be used early in the acquisition process to affordably define and verify the requirements of candidate ITE solutions for Department of Defense needs.

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IDENTIFYING THE LIMITS OF AN INTEGRATED TRAINING ENVIRONMENT USING HUMAN ABILITIES AND AFFORDANCE THEORY

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ABSTRACT

This research investigated the development and use of an analytical assessment methodology anchored in systems engineering principles, affordance theory, and human abilities, to measure the potential of integrated training environments (ITEs) to effectively support training. Empirical investigation of ITEs is costly, lacks formal guidance, and is therefore often unreliable. Ad hoc studies, commissioned by individual organizations, constitute the current state of Army ITE evaluation. These assessments are often entirely based on subject matter expert judgment through surveys, which produce results that are linked indirectly and loosely to the ITEs. What is required is a repeatable, inexpensive, analytical approach to ITE assessment that bounds the potential of a given system to the support it provides to the deliberate practice of specific tasks. The results of this research include the development and use of the integrated training environment assessment methodology (ITEAM). ITEAM was used to evaluate the ability of several ITEs to support the deliberate practice of specific tasks during training. The dissertation shows that ITEAM consistently predicted where training was supported by an ITE and generally how well. ITEAM is offered as a tool to be used early in the acquisition process to affordably define and verify the requirements of candidate ITE solutions for Department of Defense needs.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAA	American Automobile Association
AI	Area of interest
AO	Area of operation
ARI	Army Research Institute
AUSA	Association of the United States Army
CAR	Central Army Registry
CATS	Combined arms training strategies
CBA	Capabilities based assessment
CBP	Comparison based prediction
CEAT	Cost effectiveness of training
COTS	Commercial off-the-shelf
CTEA	Cost and training effectiveness analysis
DOD	Department of Defense
DSTS	Dismounted Soldier Training System
DVTE	Deployable Virtual Training Environment
FAA	Functional area analysis
FNA	Functional needs analysis
FSA	Functional solution analysis
GAT	Government Acceptance Test
HF	High fidelity
HITL	Human in-the-loop
ICCC	Infantry Captain's Career Course
I/ITSEC	Interservice/Industry, Training, Simulation and Education Conference
ISD	Instructional systems design/development
ISTEA	Initial screening training effectiveness analysis
ITE	Integrated training environment
ITEAM	Integrated Training Environment Assessment Methodology
JCIDS	Joint Capabilities Integration System
JTA	Job task analysis
LCSMM	Life cycle system management model

LF	Low fidelity
MAP	Material acquisition process
MCTC	Mission Command Training Center
MD	Material developer
MOS	Military occupational specialty
MTP	Mission Training Plan
NCO	Non-commissioned officer
NTSA	National Transportation and Safety Administration
OTS	Off -the-shelf
ORD	Operational requirements document
PFTEA	Post fielding training effectiveness analysis
PM	Program manager
POV	Point of view
RA	Research assistant
RDECOM	Research, Development and Engineering Command
RDL	Reimer Digital Library
SAT	Systems approach to training
SME	Subject matter expert
S&T	Science and technology
STTC	Simulation Training and Testing Center
SWEAT	Sewage, water, electricity, academics, trash
TA	Task analysis
TADSS	Training aids, devices, simulators, simulations
TASA	Task analysis/skills analysis
TCM	TRADOC capability manager
TCM-G	TRADOC capability manager-gaming
TD	Training developer
TDS	Training development study
TEA	Training effectiveness analysis
TEE	Training effectiveness evaluations
TEO	Training evaluation outline
TSE	Total system evaluation

TSEA	Training system effectiveness analysis
TCM	TRADOC capability manager
TD	Training developer
TOT	Transfer of training
TSP	Training support package
TTS	Training Transfer Studies
TRADOC	Training and Doctrine Command
TRAC	TRADOC Analysis Center
USA	United States Army
USMC	United States Marine Corps
WO	Warrant officer
WSMR	White Sands Missile Range
VBS2	Virtual Battlespace 2
VBS2: USA	Virtual Battlespace 2: U.S. Army
V&V	Verification and validation
VVA	Verification, validation and accreditation

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EXECUTIVE SUMMARY

This research effort focused on the investigation and development of an analytical assessment methodology to support the evaluation of human in-the-loop (HITL) simulations also known as Integrated Training Environments (ITE). Sometimes referred to as training estimation models, analytical methods of assessing ITEs attempt to use mission related tasks, operational concepts, and defined standards of execution to investigate and answer questions about ITE cost and effectiveness. This is done in an effort to avoid the expense of executing empirical transfer of training (TOT) studies. The Integrated Training Environment Assessment Methodology (ITEAM) differs in its perspective and approach. ITEAM was developed partially in response to the elimination of the Army's Training Effectiveness Analysis (TEA) system and with the view that empirical assessment techniques (mainly TOT studies) are cost prohibitive and limited. ITEAM is a human-focused, systems-engineering approach to ITE analysis. ITEAM leverages lessons learned from the literature pertaining to training as well as human ability research and affordance theory. In the ITEAM approach, ITE assessment is conducted systematically following a set of processes (Figure 1). For practical purposes, an ITE is defined as any human in-the-loop training system that includes live, virtual, constructive or game-based training aids, devices, simulators, or simulations (TADSS) alone or in combination, used to support the deliberate practice of skills for defined mission tasks.

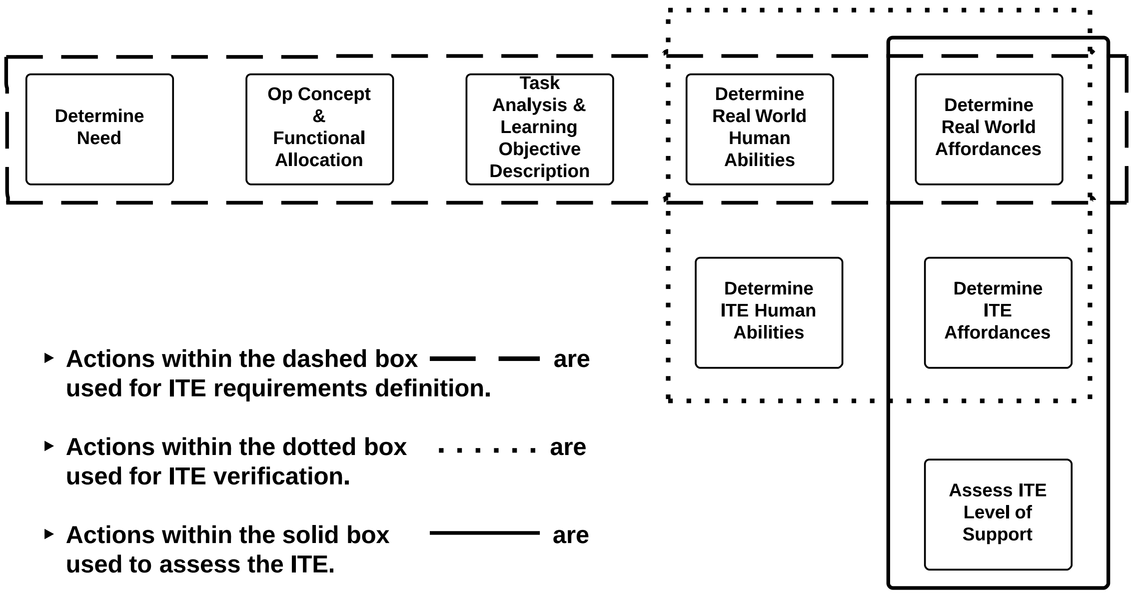

Figure 1 Integrated training environment assessment methodology (ITEAM)

The assessment process starts with defining the specific need for the ITE in the form of training outcomes. Once the need is defined, an operational concept of how the user views employment of the ITE is explored and developed. This step provides insight into the types and kinds of training that the user envisions conducting within the ITE. Next, a series of job/task analyses (JTAs) are conducted to describe the activities that will be practiced within the ITE. JTAs are noted in the literature as a major area of neglect during ITE analysis. Once completed, the JTAs are annotated with the human abilities (HA) associated with each of the tasks and task elements. This step is the first unique aspect of ITEAM. HA, were developed by Fleishman & Quaintance (1984) as part of a taxonomic effort to define human performance and work. HA provide a way to look at the ITE in human terms (e.g., physical, sensory, psychomotor or cognitive abilities) instead of technical terms. Once HA are mapped, the analyst is able to describe and define the affordances for both the real world and the ITE. This step is the second unique aspect of ITEAM. Affordances are the items that are necessary within the ITE to stimulate the human abilities of the trainee. Affordances are most often viewed using the lens of fidelity. However, determining ITE utility based solely on fidelity has been identified as problematic within the training and expertise literature.

ITEAM is a type of training estimation model. The goal of this effort was to develop an analytical assessment methodology that is able to predict task elements within an ITE with a high likelihood of positive transfer of training (TOT) to the real world. Predicting those task elements improves our ability to design and build better ITEs.

Three studies were conducted during this research. Each study re-evaluated a previously and independently conducted empirical training effectiveness analysis (TEA) of an ITE to determine if ITEAM could predict elements with high probability of positive transfer. The main result of this research revealed that an analytical assessment methodology based on human abilities and affordance theory can be used to predict areas where positive training transfer is most likely to occur. Additionally, results supported the belief that domain subject matter expertise is necessary when conducting ITE assessment but that expertise is only useful when it is applied where it truly exists. Since ITEAM does not attempt to determine appropriate levels of fidelity for ITE affordances, it cannot be relied upon to answer questions about how much stimulus is necessary for a given task. It only provides insight as to whether or not specific affordances are necessary and available. With that information, a generalized rating of ITE support for the practice of a specific task is provided. Enhancement work is needed in the scoring area to provide emphasis on critical ITE affordances. This research approached all affordances as being equal. The reality is that some tasks are more important than others and therefore some affordances are more important than others. ITEAM would benefit from the incorporation of a mechanism to reflect stakeholder value with respect to affordances. Finally, taking the time to conduct a thorough front-end analysis that identifies what is and is not needed in an ITE is of great value. If done correctly, it results in specifications of ITES where we have real confidence in the ITEs ability to support training.

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This dissertation is dedicated to my father Harry Lee Hodges (May 21, 1934–July 25, 2012). Dad passed away at the end of my first year of study, right after I passed my written exams and just as I was starting to figure some things out. We had time to talk about the things I was learning, yet every day that he is gone is another day that I won't be able to share with him the incredible journey of earning a Ph.D. Dad was a voracious reader and was a huge fan of Abraham Lincoln. I did not realize the extent of his affinity for Lincoln and the Civil War until I went home for his memorial service. My father was always learning, and he never shied away from lending advice or trying to help. Given his passion for reading and learning, I think he would have enjoyed earning a Ph.D. I know that he is watching over me from Heaven. Thanks Dad for making me the man I am. I love you and I miss you.

God has given me the gifts and talents that have made me successful. Without His invisible hand, I'd forever be lost. My parents nurtured those gifts and taught me many things like integrity, flexibility, tenacity, fortitude and personal courage. Mom, thank you for taking the time to ask about my work and encourage me. I love you very much.

Like every PhD student, I had a great committee to which I owe a huge debt of gratitude. Rudy, this is the second degree that you have helped me through. You are a true friend and colleague, and I am extremely happy that you said yes when I asked you to be my advisor. You taught me a lot and helped me discover even more. Thanks for everything. Dr. McCauley, thank you for teaching me what you know and acting as a sounding board and sometimes as a baseball bat when I needed it. Rest assured that the knowledge you have passed along and helped me to discover will not go to waste. Dr. Paulo and Dr. Appleget, thank you for providing me with the systems engineering and operations research knowledge and perspective that greatly assisted me in thinking logically and analytically during this effort. Your mentorship and friendship are greatly appreciated. I look forward to working with you in the future. CDR Joe Sullivan, Ph.D., thanks for asking to be on the committee and providing me with a sounding board for ideas.

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I. INTRODUCTION

A. A STORY TO SET THE STAGE

The intent of this dissertation is to highlight the need and develop a process for a reliable method to determine integrated training environment (ITE) utility in a cost effective manner. In August of 2012, the United States Army (USA) fielded the first installment of the dismounted soldier training system (DSTS) to FT Benning, Georgia. The DSTS, developed by Intelligent Decisions Inc., was described in a *Defense News* article as “a squad-level training tool that lets soldiers practice major combat operations and irregular warfare in a virtual world. The system includes a head-mounted display, full suit, replica weapon, sensor system and wearable computer pack” (Biron, 2012, p. 30). According to the article, the DSTS passed USA testing and evaluation at Fort Benning, Georgia.

The Army’s tool for conducting training system analysis was called the Training Effectiveness Analysis (TEA) System. Until recently, the agency responsible for conducting TEA was the Training and Doctrine Command (TRADOC) Analysis Center (TRAC) located at White Sands Missile Range (WSMR), New Mexico. Due to budgetary issues, TRAC-WSMR was forced to eliminate the division responsible for conducting TEA sometime around 2010. By regulation, TEA studies were conducted during the various phases of the material acquisition process (MAP) coinciding with major milestones. Post-fielding TEA (PFTEA), which normally occurs after a training program has stabilized, is one of several forms of analysis that no longer receive supervision.

The demise of the TEA system should be disturbing for the ITE consumer and raises important questions. If the organization (people and policy) designated to guide the conduct of TEA was not involved in the DSTS assessment, how do we know if the TEA was done correctly? Should we trust what the TEA told us? More importantly, how do we know if the DSTS is effective? This example is one that may be used to illustrate the problems associated with training effectiveness analysis.

B. INSIGHT INTO THE CULTURE OF ARMY TRAINING

When Soldiers are not training for war, they are engaged in one. As an institution, the Army has been training since 1775, and militias were drilling prior to that. Training is at the core of a soldier's life. Careers are punctuated by deliberate practice of skills and the continuous exercise of abilities during daily activity or formally planned exercises. Leaders recognize the need to maintain and increase the knowledge, skills and abilities of their soldiers if they are to maintain a decisive edge over various threats. Training management and execution within the Army has evolved over time and along with the technology that supports it. Figure 1 depicts the Army training management model, which is a continuous process driven by commanders as they evaluate the mission, develop plans to train for the threat, and assess performance based on defined training objectives.

Figure 1. Army training management model (from Department of the Army, 2011)

Commanders follow guidance and orders. They are responsible for ensuring that their units are trained and ready for war. Guidance and orders come from higher authorities. Commanders are responsible for synthesizing the complex operating environment, strategic guidance, and orders into coherent training plans. Part of the

synthesis results in a hierarchical task list of collective and individual tasks that are both critical and non-critical. The process to develop the task list is sometimes referred to as a mission essential task list (METL) crosswalk. The METL crosswalk provides traceability for the commander and higher leaders on how the unit will prepare for specific contingencies.

In the Army, we place responsibility for training execution on our warrant officers (WO) and non-commissioned officers (NCO) with the understanding that the ultimate responsibility for unit readiness remains with the commander. Our field manuals and strategic documents reinforce this situation stressing the importance of the commander's visualization and participation in the development and execution of training. The reality is that few if any of our commanders, WOs or NCOs are formally educated in instructional systems design (ISD) or the systems approach to training (SAT). At best, they are introduced to the Army's training management model during their basic school training. That introduction emphasizes the utilization of METL, combined arms training strategies (CATS) and training and evaluation outlines (TEO) to structure and evaluate soldier training and performance evaluation (Department of the Army, 2011). Commanders over-rely on NCOs and WOs as their primary trainers based on an assumption of their expertise. Our culture supports this assumption and resists any attempts to change or negate it. As a result of the culture, the Army's problems with expert overconfidence are exacerbated (Hubbard, 2009).

Officers, WOs and NCOs may be expert soldiers, but they not necessarily expert trainers. Some receive specialized training or education that better prepares them for the role of expert only in their military occupational specialty (MOS) or branch. This situation is the exception not the rule and generally the increased skills and knowledge acquired have negligible impact on their knowledge of training. As a result, the Army has flawed expectations with respect to training program effectiveness and ITE assessment.

C. DISCUSSION OF THE PROBLEM

The value of human in-the-loop (HITL) simulation training primarily comes from it's ability to offer practice opportunities in environments that replicate important features

of the real world (Salas, Rosen, Held, & Weissmuller, 2008). At some point the focus on requirements determination, definition, and solution development for military ITEs shifted focus away from human performance and skill acquisition towards advanced technology. SME participation in ITE design and an overt focus on device fidelity has further exacerbated the problem. Operational and system requirements documents (ORD/SRD), produced as part of the Joint Capabilities Integration Development System (JCIDS), have driven increasing focus on the technological aspects of possible ITE solutions while marginalizing the importance of training program effectiveness. The common practice now is to provide the technical requirements specifications for training systems to defense contractors (the what) and then require the defense contractor to provide the government with a detailed explanation of how the training systems will support the user (Klein, Johns, Perez, & Mirabella, 1985). Some people view that as the antithesis of what is inherently governmental and contractually obligated within the acquisition system. We (government) should be describing the desired outcome (trained personnel) and leaving the exact specification of a solution (the what) to the contractor.

Research in ITE development provides insights into the challenges faced by the training developer (TD) and material developer (MD), and how time has turned a logical, deliberate and well-meaning analysis process into just another check-the-block event. Kane and Holman cited in Hays & Singer (1988) refer to the situation where people involved in the training development process are more focused on paperwork than the substance of the paperwork, as “the pass through problem.” A commonly reiterated theme on the lack of front-end analysis is found throughout the academic and military research literature. Abiding by the letter of the law literally, has become more important than executing the due diligence of analysis ensuring that requirements are accurate, effective and efficient. At the executive level, the training development process has become overly focused on proper briefings, timelines and budgets.

Between conflicts, the Armed Forces rely on ITEs to maintain warfighting skills. Integrated training environments are where Soldiers, Sailors, Airmen and Marines practice the skills and engrain the knowledge necessary to execute their combat missions successfully on the battlefield. ITEs are extremely resource intensive and are rarely

described as lightweight or turnkey. ITEs require verification, validation and accreditation (VVA) just as their analytical counterparts that support budgetary and force structure decisions. A major difference between the training aids, devices, simulators and simulations (TADSS) that support ITEs and other types of simulations, is how they are evaluated.

Traditionally, researchers have attempted to assess the value of training simulations and training enablers using empirical means such as transfer of training (TOT) studies. The literature reveals that both laboratory and applied experimentation in the form of TOT studies suffer from many difficulties that makes relying on them potentially problematic (Milham, Carroll, Jones, Dean, & Chang, 2008). TOT studies become very difficult to execute during periods of decreased resourcing, and they often focus on the physical fidelity of an ITE compared to its operational counterpart (Burnside, 1990; Sticha, Campbell, & Knerr, 2002). Sometimes functional and psychological fidelity are considered when investigating the cognitive support a training system provides, but this occurs less often. More frequently, TOT studies are characterized by the use of subjective survey data and advanced statistical techniques that are used to create support for weak inferences made concerning system utility.

Researchers have attempted to develop ways to evaluate training programs and systems using non-empirical means in an effort to reduce costs and accurately capture positive system attributes (Gilligan, Elder, & Sticha, 1990; Keesling, King, & Mullen, 1999; Sticha et al., 2002; Tufano & Evans, 1982). Despite their best efforts, only a handful of researcher’s techniques have been successfully implemented outside of the research arena. Few of the implementations have been used more than a handful of times.

The formal training effectiveness analysis (TEA) system within the USA officially ended in summer 2012 (Drillings, 2013). The TEA system was the Army’s means of guiding the assessment of training programs and devices in support of the material acquisition process (MAP). With the demise of the TEA system no formal policy or directed methods exist for guiding ITE assessment.

D. RESEARCH APPROACH

The methodology developed in this dissertation can be classified as a training estimation model. As described by Muckler and Finley (1994) training estimation models are mainly for evaluating training system designs and are design tools that allow for a level of prediction of training success before system development. We take this a step further and assert that this estimation model may also be used as a guide to evaluate ITE utility. Training system estimation models allow for analysis of alternatives that may be developed through the instructional systems design (ISD) process. We acknowledge that estimation models have layers and that this research effort only addresses some of them. The future work section points out areas and actions that should be examined in order to continue the refinement of this methodology.

The focus of this dissertation is on assessing the utility of ITEs to support the deliberate practice of tasks and skills involved in military training. Figure 2 depicts the logical process taken during this research. Every research effort is guided by questions, assumptions and a hypothesis. The hypothesis for this research effort is that *an analytical assessment methodology based on human abilities and affordance theory can predict task elements within an integrated training environment with the highest likelihood of positive transfer of training.*

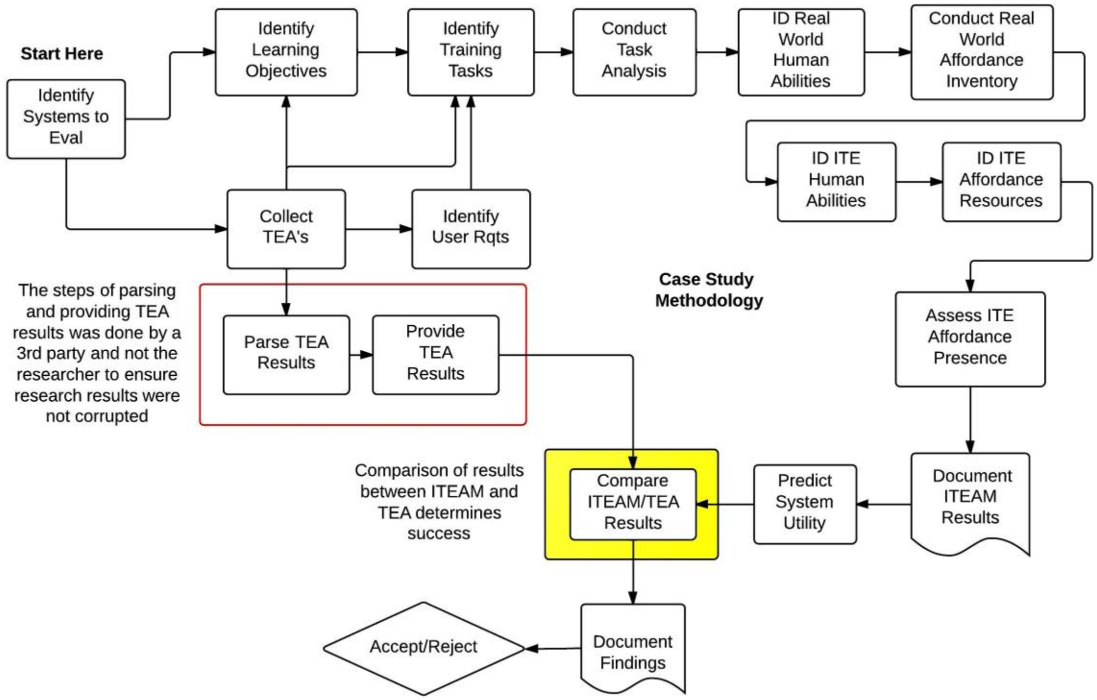

Figure 2. Pictorial representation of dissertation research process

The first step of this process identified training simulation programs to serve as case studies. TEA had been previously conducted on these systems so they could be used for comparison with the analytical technique developed as part of this research. Once candidate systems were identified, TEA studies were obtained and sanitized by removing the study results and data. This process was executed before we began our assessment approach to prevent the corruption of our results. Once stripped of data and results, we parsed each TEA to identify learning objectives, training task requirements and any other information needed by our methodology. Next, we conducted a task analysis on the mission and task data derived from each TEA study. The TA was done to the level of detail necessary to support the identification of the real world human abilities (HA) and real world affordances. A similar process was conducted to identify the human abilities and affordances that the subject ITE supported and contained. Once the real world and ITE HA and affordances were listed a scoring process was applied to determine a measure of how well the ITE could be expected to support the practice of the identified tasks. The results of this activity identified strengths and weaknesses in the studied ITEs.

Formalization of the process provides the description of the Integrated Training Environment Assessment Methodology (ITEAM). Results from the ITEAM assessments were compared to the results of the government TEA studies to demonstrate the predictive value of the analytical assessment methodology.

E. CLARIFICATION OF TERMS

Words have specific meanings and when used inappropriately they confuse and lead to a poor understanding of a situation. The words model, simulation, simulator and modeling and simulation have been used interchangeably to mean the same or drastically different things. As evidenced in the next chapter, these words have different meanings when used in different contexts. To provide the reader with the necessary perspective to understand our point of view, the following definitions are provided.

- **Model**: A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process (Under Secretary of Defense, 1998).
- **Simulation**: A method for implementing a model over time (Under Secretary of Defense, 1998).
- **Simulator**: A device that duplicates the essential features of a task situation and provides for direct human operation (Under Secretary of Defense, 1998).
- **Fidelity**: The degree of similarity between the training situation and the operational situation, which is simulated. It is a two dimensional measurement of this similarity in terms of the physical characteristics and the functional characteristics within the environment (Hays & Singer, 1988).
- **Integrated Training Environment**: Any human in-the-loop training system that includes live, virtual, constructive or game-based training aids, devices, simulators, or simulations (TADSS) alone or in combination, used to support the deliberate practice of skills for defined mission tasks (Hodges, Darken, & McCauley, 2014).

F. DOCUMENT ORGANIZATION

Chapter I introduces the problem and provides the reader with an example placed in context designed to stimulate thought about the problem. The chapter describes the

research approach to be used in the dissertation. It also, provides clarity on several terms that will be seen and used throughout the dissertation document.

Chapter II discusses the literature within the problem domain. The chapter includes a review of front-end analysis including task analysis, human ability analysis, fidelity, affordance theory and transfer of training. Verification and validation, the impacts of subject matter experts, various forms of simulation assessment, and the USA training effectiveness analysis (TEA) system also are covered.

Chapter III introduces and discusses the integrated training environment assessment methodology (ITEAM).

Chapters IV, V, and VI describe case studies where ITEAM was used to assess the utility of three ITEs. The results of the ITEAM assessments and previous TEAs are compared to demonstrate ITEAMs ability to analytically predict the utility of the ITEs for the deliberate practice of specific tasks.

Chapter VII provides a discussion on the application of ITEAM and the overall results and impressions obtained from using ITEAM as an ITE assessment tool.

Chapter VIII provides the conclusions from the research and recommendations for future work to extend and improve on ITEAM.

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II. LITERATURE REVIEW

The focus of this dissertation is on assessing the utility of an integrated training environment (ITE) (i.e., how well does an ITE support the deliberate practice of skills necessary to accomplish specific tasks at the human ability level?). In order to assess an ITE's utility, several things must be considered: (1) the need, operational concept and functional allocation for the ITE (2) the intended learning/training objectives for trainees (3) the tasks that support those learning/training objectives and (4) the standard for performance. Figure 3 depicts just a few of the factors that impact the assessment of training simulations.

This literature review opens with a discussion about front-end analysis to include capabilities based assessment (CBA). CBA acts as our entry point into ITE development and is found within the boundary of the Joint Capabilities Integration and Development System (JCIDS). The discussion on CBA is followed by a discussion of the literature dealing with learning and performance objectives, task analysis (TA), human abilities (HA), fidelity, affordance theory and transfer of training (TOT). Linkages between TA and HA, affordance theory and fidelity are provided. From there the focus shifts briefly to the subject of verification and validation (V&V). Similarities between validation and other forms of assessment are mentioned. A brief review of the impact of subject matter experts (SME) precedes the section pertaining directly to analytical simulation assessment methodologies. That review is followed by an introduction and overview of the USA TEA system. The chapter concludes with a brief summary of all of the material discussed.

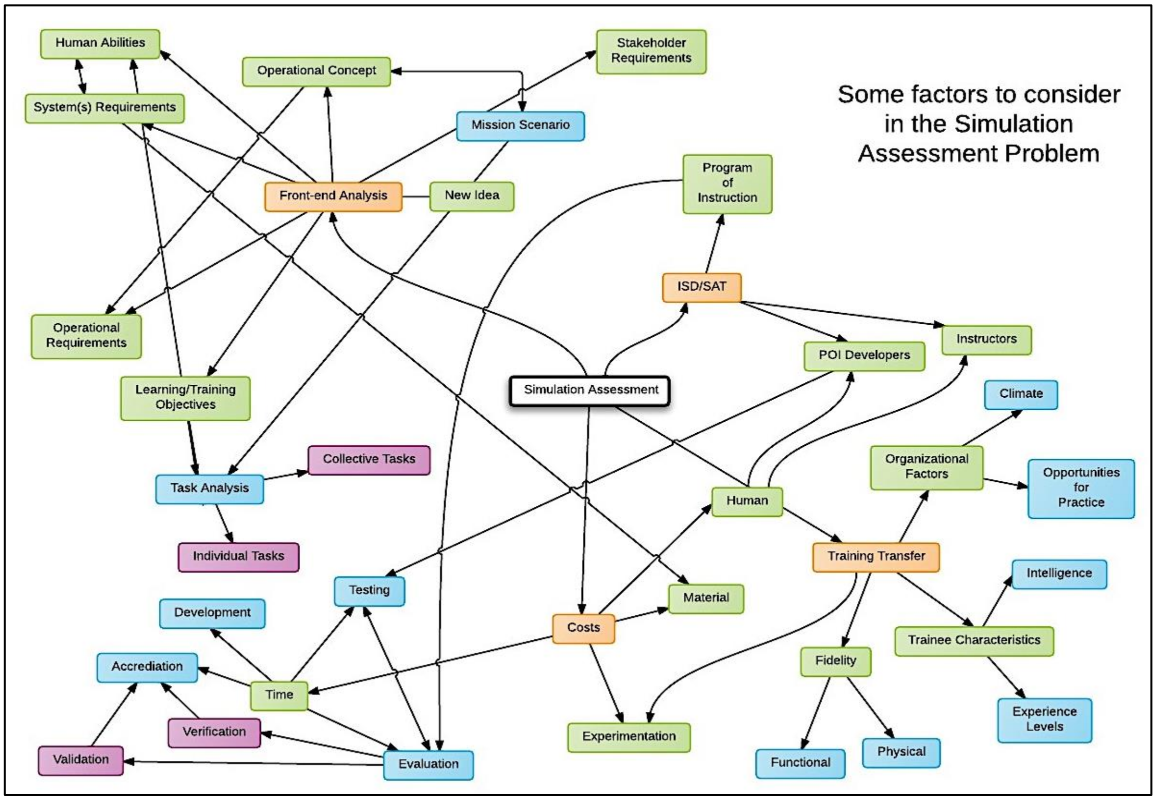

Figure 3. Considerations when dealing with simulation assessment

A. FRONT-END ANALYSIS

Front-end analysis includes those activities necessary to define and describe the training problem and the supporting solution attributes prior to the development of any technical system specification and requirements documents. When discussing front-end analysis, we focus on those activities that support the definition of training solution function without regard for the training solution form. Training solution form should always follow function, however, as we will learn, in practice that is not always the case.

Many considerations must be addressed when developing a training program or device (e.g., the purpose of the training device; the trainee population; the time allotted for training; the tasks to be trained; the training objectives that specify the level of transfer required; the monetary costs associated with various design alternatives; and often, the engineering state of the art) (Cream, Eggemeier, & Klein, 1975; Hays & Singer, 1983; Muckler & Finley, 1994a; E. Salas et al., 2008; Eduardo Salas & Cannon-

Bowers, 2001; Smode & Hall, 1975). These items reside within the analysis and design of training stages of instructional systems design (ISD). They should be aligned with the analysis phase of the JCIDS process known as CBA.

1. Capability Based Assessments

The Department of Defense (DOD) utilizes JCIDS as the systematic means of analyzing and determining capability based requirements and solutions applicable across all services. JCIDS begins with a stakeholder need that identifies a perceived gap in operational capability. From this need follows a series of assessments. The assumption until now has been that the CBA process works to provide the maximum amount of detail needed to feed the larger JCIDS process in an effort to determine the best capability solutions possible. However, published documentation leads us to a different conclusion:

> The preference is to avoid high rigor and time-consuming detail in the CBA, and concentrate on whether to recommend action. CBAs that are tightly focused on recapitalization, replacement actions, evolutionary needs, or information systems should take no more than 90 days, while more complex CBAs dealing with large uncertainties should take no more than 180 days. (Training and Doctrine Command, 2011, p. 64)

The preference is for CBA to be a "quick and dirty" process that merely makes the case for a procurement or development project. There is no expectation or desire for CBAs to be full-scale analyses that crisply define requirements or gaps to be filled.

Development of simulation-based training devices often takes years with production taking longer. Yet, the initial front-end analysis essential to support their development is required to be completed in 180 days or less. This is not just a USA policy—rather it is one dictated within the JCIDS regulations as well. This time compression has led some to suggest that conducting assessments early in the developmental lifecycle is infeasible unless the requirements document process undergoes revision (Tufano & Evans, 1982; Wheaton, Rose, Fingerman, Korotkin, & Holding, 1976). CBAs are composed of several sub analytical steps, namely the functional area assessment (FAA), the functional needs analysis (FNA) and the functional solution analysis (FSA). Guidance for much of the front-end analysis for training system design is provided in the MIL-HDBK-29612-2A Department of Defense Handbook,

Instructional Systems Development/Systems Approach to Training (ISD/SAT) and Education [Part 2 of 5] (Department of Defense, 2001).

Reviews of recent CBA documentation (i.e., FAA, FNA or FSA) demonstrate the importance of explicitly aligning perceived capability gaps with joint and strategic guidance priorities. What is missing from the CBA is any discussion of TA, training requirements, learning objectives or any other ISD/SAT attributes, which are all essential. This situation is the result of the JCIDS policy guidance that states:

> Since the JCIDS process ultimately identifies which gaps are pervasive or important enough to address, the suggested gaps must be directly linked to operational situations and the consequences of failing to meet objectives. The FNA results in a prioritized list of gaps that are directly linked to priorities in strategic guidance. (Training and Doctrine Command, 2011)

While alignment with strategic interests is essential during times of decreasing resources, the JCIDS process has been systematically eroded in areas where critical in-depth analysis is necessary (GAO, 2012). Artificial time constraints and personnel cuts in offices responsible for conducting the front-end analysis for training systems (i.e., training developers—those people responsible for training program ISD/SAT analysis) have created a situation where analysis is either not done, is done poorly by individuals who do not understand the process, or is left up to the contractor to conduct.

> TRADOC training developers (TD) do not lead the JCIDS process, and in fact are only one facet of that process, and a weak facet at that. TRADOC is woefully short TDs and the ones that still exist are usually farmed out to other positions not related to training development. TRADOC leadership is aware of this shortfall. (Marco Conners, personal communication, August 27, 2012)

Despite several attempts to locate training developers with experience in conducting front-end analysis for system development, none could be located to contradict or confirm this statement. Attempts took the form of multiple emails and phone calls to the U.S. Army Maneuver Center of Excellence, the U.S. Army Aviation Center of Excellence and the TRADOC capability management office for virtual systems (TCM-V).

2. Training Objectives and Performance Requirements

ITE development is headed in the right direction when developers seek to comprehend the mission requirements, training objectives (TOs), tasks, and task requirements that an ITE is to support. TOs should be explicitly provided to ITE developers where they can be used to develop criterion measures that ultimately support the empirical validation of the ITE and training approach (Department of Defense, 2001). Scholars believe that providing TOs to ITE developers is important because TOs include critical information about task performance that should be considered during the development of ITE specifications. Analysis should also include consideration about how an ITE will be constructed to facilitate the effective translation of inputs and outputs between the ITE and the real world (Milham, Carroll, Stanney, & Becker, 2003; Salas, Milham, & Bowers, 2003; (Rose, Wheaton, & Yates, 1985). The USA defines a TO as a statement that describes the desired outcome of a training activity, which consists of the tasks, conditions, and standards (Department of the Army, 2011). For this research, TOs are viewed as key elements for any analytical model used to predict the utility of an ITE before it has actually been designed and developed.

Muckler and Finley (1994a) discuss how the development of TOs is a step that is frequently ignored or done poorly during ITE development. They believe most ITE end-users cannot articulate what their training needs are. Furthermore, they are ill equipped to provide useful technical input. End-users do not understand the possibilities of a new technology and often tend to fall into one of two categories, either extremely positive ("this system is awesome!") or inappropriately negative ("the last thing we need is another computer device to help us train!"). Muckler and Finley (1994a) go on to say that the TD's lack of knowledge has led to a situation where the ITE developer is the one who produces the TOs for the system. Our position is that the TOs and performance objectives should be provided by the customer (i.e., system end-user and TD) and used by the ITE developer as a guide to steer ITE development. Failure to do this exposes the government to unnecessary risk and likely poor results. The customer (i.e., system end-user and TD) has the responsibility to establish training requirements so that the entire ITE research and development community can respond in support.

Performance requirements, stated as standards for military training, should be driven by decisions about which type of measurement is desired (i.e., “outcome-based” or “performance-based”). Outcomes-based evaluation focuses on achieving the ends without concern or focus on the means (Foster, 2009). Performance-based methods focus on the means to achieve the end as well as the end itself. Performance-based proponents argue that understanding what causes behavior is a key to determining the causes of poor performance (Salas et al., 2008). Military training is characterized as having both outcomes and performance-based requirements.

Rose, et al. (1985) discuss how performance requirements are often derived from either detailed design descriptions of equipment or from job descriptions of system operators. They describe how TDs use job descriptions as a source of data for determining the best way to develop ITEs and training programs. Typically, jobs are described in the form of task or skill analyses (TASA). Unfortunately, TASA have little impact on the development of ITEs during the material acquisition process (MAP) for two reasons. First is the bootstrapping nature of ITE development. During the MAP the operational system takes priority. Second is the timing of TASA arrival. TASA often arrive after decisions about ITE design have been made.

3. Task Analysis

A commonly reiterated theme within the training literature is that task analysis (TA) is the most important step in ITE or training program design (Hays & Singer, 1988; Darken, 2009; Montague, 1982; Muckler & Finley, 1994; Sticha et al., 2002; Simpson, 1995; Bloom & Yanko, 1986). TA is included as an important topic in many human factors engineering and training course textbooks (Patrick, 1992; Sanders & McCormick, 1993; Wickens, Lee, Liu, & Becker, 2004). TA falls within the boundary of the FAA portion of the CBA and is left to the training or ITE proponent to develop. Yet, when reviewing many ITE development documents, it appears that TA is not given the attention necessary to assure that it has the intended impact on the process. If executed at all, TA that supports ITE development tends to be superficial and does not appear to influence design decisions in any meaningful way.

TA is done for many purposes, one of which is to support the development of a training program. Generally, insight is required from the execution of an action, process or decision to support training or ITE development. For a TA to begin there must be an understanding that the results will provide necessary information for the advancement of some desired goal. When done properly, TA can be described as a laboriously detailed endeavor (Annett, 2004), which is perhaps the reason that it is done incorrectly, if at all. A point rarely considered, is that despite the effort required to execute a TA, the TA itself has a long shelf life. Expectantly over time, TAs may require minor updates or adjustments to account for the evolution in technology that supports activity. Executing a TA is a small price to pay considering the benefits that the TA provides in supporting various decisions throughout an ITE's lifecycle.

Various forms of task analysis have been developed over the years (e.g., Time Study [Frederick Taylor], Motion Study [Frank Gilbreth], Task Description Analysis [Robert Miller], Critical Incident Technique [John Flanagan], Hierarchical [J. Annett and K. Duncan], GOMS [S. Card, T Moran and A Newell], and CDM [Gary Kline]) (Schraagen, 2006; Crystal & Ellington, 2004; Hollnagel, 2006). Each TA approach was developed to support the collection of information for a specific problem. There is little disagreement about the importance of conducting TA, however, there is some disagreement amongst authors about what form of TA is appropriate for a given situation. Because the results of these TAs are relied upon to support training programs and assessment models, some suggest that the assessment models may be the best place to start for determining which form of TA should be used (Hays & Singer, 1988; Muckler & Finley, 1994a, 1994b). One assumption made in this research is that the function of TA is more important than the form of the TA. The technique employed to conduct the TA should support the goals of the TA. As long as this is true, the TA should be sufficient.

TA reveals more than just information about performance. A good TA also supports an understanding of the characteristics of the ITE. Without executing the proper level of TA, stimulus levels and ITE factors necessary for effective training support remain hidden. TA supporting ITE design must be done to yield the rich information on the factors that control and affect task performance as well as on the performance itself

(Smode & Hall, 1975). The level to which TA must be executed depends, therefore, on the performance objectives and desired training outcomes (Annett, 2004; Cockayne & Darken, 2004). This research will conduct TA to the level that supports an understanding of what is needed from the ITE to support the deliberate practice of specific tasks.

4. Human Ability Requirements

a. Introduction

Too often, the focus of solutions to training capability gaps are too narrowly fixated on technology instead of an understanding of the training objectives, performance requirements and tasks, which enable effective training. For years, it seems that most of the work done by training specialists and system developers has focused on developing solutions to ill-defined training problems. It seems that a common assumption is that the more complex and highly technical a training solution is, the better it is. Walking the showroom floor at the Association of the United States Army (AUSA) conference or the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) supports this assertion. It is the unusual case to find any system at either of these shows that can produce substantive documentation supporting claims of training effectiveness. We are asked to trust that training support is good because the technology employed looks good. Unfortunately, the research conducted in TOT and ITE assessment has not provided overwhelming empirical evidence to support the assumption and it is unclear whether the focus on technology has been worth the cost (Muckler & Finley, 1994a).

Human ability research has been ongoing since the 1960's and has been used as a tool for empirical work investigating training system design and fidelity (Hays & Singer, 1988; Napoletano, 2013). Initially, the Defense Advanced Research Projects Agency (DARPA) sponsored research into human abilities to assist the military with job placement and training (Cockayne, 1998). The human abilities body of research has been developed as part of an umbrella taxonomic effort attempting to standardize the way human performance is described.

b. Impetus for Development

As described by Fleishman and others, the various fields that make up the domain of human performance research suffer from a lack of established taxonomies by which they are able to discuss human task performance (Darken, 2009; Fleishman & Quaintance, 1984; Fleishman & Bartlett, 1969). The goal of the taxonomy project was to make progress towards a common task-descriptive language that would assist in integrating the human-performance research literature. Taxonomies become essential when experts from various fields who use similar terminology attempt to work together to solve complex and shared problems. Without a mutually understood means to discuss the characteristics of a problem, little can be accomplished. The objective of the ability requirements approach was to identify and define the fewest number of independent ability categories that would be useful and meaningful for describing performance in the widest variety of tasks (Fleishman & Quaintance, 1984).

Human ability development is an iterative process intended to produce a list of verified abilities that are empirically derived from patterns of responses to different tasks. The assumption is that specific tasks require certain abilities and that tasks requiring the same types of abilities can be categorized similarly. This assumption allows researchers to discuss task performance in relative terms. The human ability project, through experimentation and collaboration with multiple subject matter experts, derived 52 human abilities with the possibility of adding more. Examples of human abilities are oral comprehension, deductive reasoning, mathematical reasoning, dynamic strength, gross body coordination, peripheral vision, depth perception, and sound localization. Abilities are grouped into one of four categories (i.e., physical, sensory, psychomotor and cognitive). The United States Department of Labor uses human abilities as the basis for their O*NET (http://www.onetonline.org) program that provides information about jobs based on the human abilities needed to execute them.

c. Relationship to This Research

Ability refers to a human's capacity to do something. Skill refers to the proficiency of a specific person in doing something. Through years of research,

Fleishman and his colleagues analyzed various jobs and tasks to ascertain and develop a list of 52 human abilities that can be found throughout various human activities. During this process, they executed numerous TAs. Through their process of defining ability requirements, they were linking information dealing with task characteristics to human abilities (Fleishman & Mumford, 1991; Fleishman & Quaintance, 1984; Fleishman & Bartlett, 1969). The results of their efforts led to means of description, understanding and categorization of human activity (i.e., work) based on human abilities instead of through the use of TA. Abilities are viewed as enduring attributes of the human being (i.e., they are the same in the real or virtual world). They play an important role in the methodology that allows us to determine the utility of an ITE. A complete list of the human abilities is provided for the reader in Appendix A.

B. FIDELITY, AFFORDANCE THEORY AND TRANSFER OF TRAINING

1. Fidelity

Design decisions concerning fidelity should be made with an understanding of the training requirements that support knowledge and skill acquisition comparable to the operational environment (Milham et al., 2003; Smode & Hall, 1975). This view contradicts the common reality of ITE acquisition where the major focus is on device fidelity or on obtaining a device that contains the most fidelity and instructional features as the budget will allow (Rose et al., 1985). The focus on fidelity excludes any consideration for other aspects of the training program such as the effective use of instructors or ensuring the proper instructional settings. Hays and Singer (1988) point out that there is mixed data on the positive effects of high technology media on transfer of training (TOT). Some suggest that analyzing additional data on the impacts of fidelity in device design before leaping to develop more unfocused technology makes sense (Darken, 2009; Muckler & Finley, 1994a; Rose et al., 1985). One glaring reason for this recommendation is the dominating role fidelity has played in IET effectiveness discussions. This domination is due to fidelity being the most observable and expensive attribute of an ITE.

In work supported by the Army Research Institute (ARI), Montague (1982), noted that often design parameters for ITEs are not specific about what training requirements the ITE must support. This situation limits the effective measurement and evaluation of the ITE in a training setting. Montague (1982) also points out that program managers (PMs) who are responsible for ITE procurement programs know little about training design principles and therefore, do not consider them. PMs do not understand or consider learning theory or the effects of performance measurement, feedback, and practice on learning. Counterintuitively, ITE effectiveness may be due to violations of system physical and temporal isomorphism. This is a hard concept for many to accept especially if they believe that the most important goal in ITE design is to provide high physical and stimulus fidelity. Effective ITEs need to faithfully support the simulation of the tasks to be learned in ways that teach users how to think and assist them in building appropriate mental models (Montague, 1982). In other words, fidelity is more appropriately focused on the task versus the device.

Fidelity requirements should be a derivative of front-end analysis. Few standards or guidelines exist that define what constitutes effective or sufficient fidelity or that translate task analysis information into a form that facilitates fidelity decisions (Smode & Hall, 1975; Hays & Singer, 1988). Sometimes standards enforcing fidelity have been established based on the complexity of the job situation (e.g., Nuclear Power Plant operation) (Levinson & Donovan, 1984). Fidelity is often associated with only the physical aspects of a system—those things that can be perceived by the senses. The idea that fidelity is composed of both physical and functional aspects has been discussed in detail in the three volume report produced by ARI (Rose, Martin, & Yates, 1985; Rose et al., 1985). Research has provided evidence that psychological fidelity is more important than physical fidelity (Baldwin & Ford, 1988). However, the tendency has been to relate system effectiveness with physical likeness based on the operational equipment it mimics. This tendency can be traced back to the identical elements theory postulated by Thorndike and Woodworth (Thorndike, 1932). Thorndike stated that the more identical elements two tasks shared, the more similar they were, which supported the prediction for more positive transfer of training (TOT) (Patrick, 1992). Empirical research has

demonstrated this situation to be true in some areas (e.g., the retention of both motor and verbal behaviors). However, other research reveals that having identical elements between tasks or systems is a necessary but insufficient condition for positive TOT to occur. This sentiment is also offered about the relationship between learning and training (Baldwin & Ford, 1988; Patrick, 1992). While Thorndike and Woodworth's theory of identical elements has generally held as a basis for both TOT and device high fidelity recommendations (Muth & Switzer, 2009), Hays & Singer (1988) highlight the flaw in the logic behind using only physical fidelity as a determinant for TOT. They affirm that an ITE is made up of technology, people, processes and documentation, as well as the relationships between these elements. If the pieces are viewed individually, many qualities derived from the interactions of these various parts are lost. This is a significant reason for not solely basing judgment of ITE effectiveness on physical fidelity.

ITE fidelity is an important consideration when evaluating TOT. The purpose of this research is to identify the utility of an ITE to support TOT using the hypothesis that *an analytical assessment methodology based on human abilities and affordance theory can predict task elements within an integrated training environment with the highest likelihood of positive TOT*. We are not conducting a TOT study or an analysis of the level of fidelity necessary for TOT. The focus on fidelity here supports the identification of ITE affordances necessary to stimulate the human abilities associated with the task elements specified for practice within the ITE.

2. Affordance Theory

This dissertation focuses on the classification of an ITE's utility in supporting the trainee, specified training objectives and performance requirements by focusing on the affordances resident and absent within the ITE. Affordance theory comes from ecological psychology and James J. Gibson. Gibson (1986) coined the term "affordance" to capture the essence of what an environment offers or provides an animal in either a positive or negative fashion. Affordance theory provides a context for discussing the qualities of the human-environment relationship within an ITE. Precedent exists for the use of affordance theory in supporting computer science and human factors research (Bærentsen &

Trettvik, 2002; Chemero & Turvey, 2007; Lintern, 2000; Rome, Paletta, Şahin, Dorffner, Hertzberg, Breithaupt, Fritz et al., 2008). Affordance theory is naturally associated with human abilities, most notably with human perception.

Gibson intended for affordances to represent something that refers to both the environment and the animal unlike any existing concept. Affordances are perceived by the animal, but they are independent of the act of perception; they are action-referential properties of the environment (Michaels, 2003). Gibson believed that affordances could not be directly measured. An example of what an affordance is can be found by examining a coffee mug. A coffee mug affords several things—a way to be held (handle), a way to contain or carry liquids and support for drinking. A more relevant example is an ITE that has been designed to train Highly Mobile Multi-purpose Wheeled Vehicle (HMMWV) drivers that contains vehicle mock-ups. Without knowing the extent of mock-up fidelity, we can assert that this ITE affords some level of HMMWV training. The extent of the ITEs utility for specific HMMWV training requires further analysis of tasks and performance objectives as previously mentioned. Since affordances are relative to the animal (in this case a human), a new soldier viewing a HMMWV mockup will perceive different affordances than a more seasoned NCO who has extensive experience with a HMMWV.

Gibson (1986) believed that perceiving was not a process of assigning value to an object. Rather, it is the process of recognizing the inherent value, benefit or harm that an object or situation provides. Affordances exist as properties of both static and action states in the training environment (Stoffregen, 2003). This concept is important in regards to this research as the methodology developed herein is meant to provide insight into the utility of an ITE that contains both static and active states. In a break with other psychologists, Gibson believed that, while objects have qualities such as color, size, texture, and shape, those are not what humans perceive. Rather, he asserted that what we perceive is actually what the objects afford. This concept is intuitive in regards to physical objects. With respect to the affordances of behavior, however, Gibson stated, "behavior affords behavior" (Gibson, 1986, p. 135). He proposed that the affordances of

behavior depended upon the perception or misperception between animals making the identification of behavioral affordances less certain.

Gibson’s theory of affordances has been met with varying degrees of enthusiasm and criticism over the years (Jones, 2003b). Controversy over opposing ideas prompted a special issue of the *Journal of Ecological Psychology* dedicated to a debate on the subject (Jones, 2003a). As initially described, the concept of affordances was simple, clear and appealing (Michaels, 2003). However, Gibson’s later attempts to describe affordances in more detail, resulted in a situation that “makes them seem like impossible, ghostly entities, entities that no respectable scientist (or science worshiping analytic philosopher) could have as part of their ontology” (Chemero, 2003, p. 182). Attempts at providing clarity and concrete definitions for affordances have been offered and debated (Stoffregen, 2003; Turvey, 1992). Unfortunately for the scientific community, Gibson died before he had the opportunity to solidify the concept of affordances for the field of ecological psychology and the world. While various perspectives continue to exist within the domain of ecological psychology over affordances, further elaboration of their discussion remains outside the scope of this research effort. Readers interested in further discussion of affordances and affordance theory are directed to (Gibson, 1986; Jones, 2003a).

Affordances and affordance theory are used in this research as a means of identifying the qualities and characteristics of the ITE that are absent or present in relation to the human abilities associated with specific tasks. We have elected to use affordances as part of our methodology because they provide context and afford us an opportunity to view an ITE unlike any other approach. Using affordances we are not only able to identify the characteristics of an ITE that support deliberate practice; but also why those identified characteristics are important to the trainee’s execution of the tasks. Through the use of affordances, we are able to determine specific task elements with the highest likelihood of positive TOT.

3. Transfer of Training

The following section provides a review of the transfer of training (TOT) literature. This review is based on four meta-analyses (Baldwin & Ford,1988; Ford &

Weissbein, 1997; Salas & Cannon-Bowers, 2001; Blume, Ford, Baldwin, & Huang, 2009). These four meta-analyses provide a comprehensive review of the literature that spans a century. Unless indicated otherwise, all of the material in this section was obtained from these four references.

Positive TOT is the ultimate goal and reason for every training program. While we acknowledge this goal, TOT is not the primary focus of this research effort. There are no attempts made to identify measures of performance or to evaluate training or specific training systems. Rather, our focus is on an ITE's ability or potential to support deliberate practice. We recognize that this research effort is a small piece of a larger training program "puzzle" that is very concerned with TOT. Therefore a review of the current literature has been conducted and is presented here with an eye towards TOT's impact on ITE utility.

Training is expensive to execute. Various authors have provided cost estimates over the years of what industry spends on training and what percentage is believed to be effective. Estimates provided are $125 billion spent on training with 10 percent believed to be effective (Baldwin & Ford, 1988; Blume et al., 2009). While training is expensive, conducting research into its effectiveness is an additional expense. A positive note within the literature is that the amount and quality of research into TOT has improved. Previously there existed a belief that only a limited number of fragmented empirical studies existed. Now there is an understanding that more training related research is available than in the past three decades (Baldwin & Ford, 1988; Salas & Cannon-Bowers, 2001).

Figure 4 visually describes the TOT process. The dashed lines indicate linkages of inputs to outputs and conditions of transfer. Recent reviews have clarified where the impacts of technology, characteristics influencing the technology (e.g., fidelity), the effects of feedback, and practice are incorporated in the diagram. These factors are important because the early trend in TOT research focused solely on training outcomes whereas today the focus is more on evaluating the training process. When investigating the training process, the impacts of technology must be considered. Outcome-based assessment does not provide the necessary insight into where training and technology use

is sub-optimal. Conversely, process-based assessment has its challenges as well, one being attempting to identify where and how technology best supports the execution of complex military tasks. Challenges in properly applying technology in training add to the difficulty in successfully using process-based evaluation techniques (Milham et al., 2003). These points are important to consider because this research attempts to identify limitations in ITEs consisting of various devices (i.e., TADSS) that impact the deliberate practice of specific tasks.

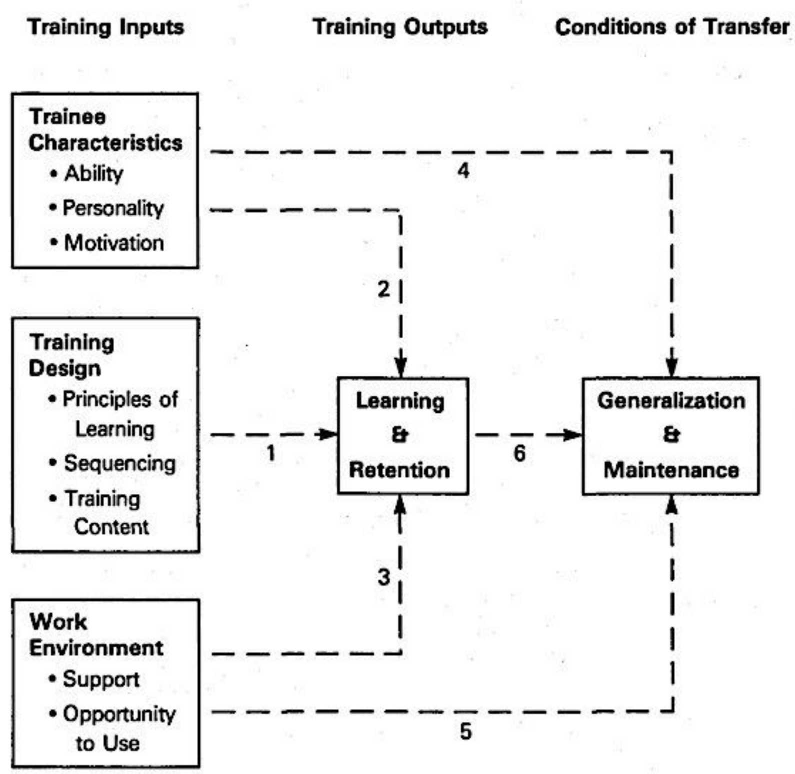

Figure 4. Training transfer process model (from Baldwin & Ford, 1988, p. 27)

Due to the ambiguous nature of military operational environments, various training design architectures (e.g., the general principles approach and stimulus variability) are very applicable to military training and TOT. These two approaches view specific skills training, heuristics, and variations in the stimulus presented during training as being valuable when designing training that facilitates transfer. All of these items when used in concert have an impact in training higher order cognitively intense tasks.

An important subject receiving well-deserved emphasis today is the trainee and those trainee characteristics that enhance TOT. Research into trainee characteristics ranges from topics of motivation to intelligence. Discussions about the trainee in relation to TOT provide a consistent theme—TOT is greater with trainees who demonstrate the characteristics of self-confidence, positive motivation and self-efficacy. Intuitively, intelligence is also a key variable in whether or not trainees will be successful but the impacts of intelligence have demonstrated task and situational dependence. We believe that the focus on the trainee is paramount. This research places the trainee in the center of the assessment methodology through the use of both human abilities and affordances.

The TOT literature reveals an overt focus on training input factors, rather than one on investigating the appropriate measurement of transfer conditions. The lack of focus on transfer conditions continues to hinder our understanding of which design factors contribute to or detract from transfer. This is important to the current research effort because we focus our attention on the ITE itself. We examine the ITEs ability to support the deliberate practice of tasks based on the affordances available to facilitate task execution. The results from our examinations provide information that supports a better understanding of important design factors within an ITE.

The meta-analysis done by Blume et al. (2009) points out a significant element missing from the literature, which is the impact of training objectives on transfer. While the literature notes that training objectives are intended as the outcomes from training, their use as a guide to direct the selection of evaluation criteria for TOT studies is eerily absent. This is reinforced in the task analytic, simulation assessment and fidelity literatures that all comment on the lack of emphasis placed on training and learning objectives.

Emerging research includes the idea that error-based learning provides for better transfer to an operational setting. Instead of constructing ITEs that minimize the effects of errors, new error-filled ones are being employed. Those ITEs immerse and engage trainees more actively. These are the kinds of ITEs where trainees are allowed and possibly encouraged to make errors so that they may practice adaptive decision-making.

These types of ITEs further reinforce the general principles and stimulus variability approaches to training design, which were previously noted as being important to military leader development.

The ultimate goal of TOT studies is to demonstrate improved human performance. A brief but applied review of the literature on TOT has been provided and its importance to the current research has been discussed. As the literature has pointed out, there are many variables in the TOT puzzle. This dissertation supports the resolution of the TOT problem by providing a way to examine ITEs to determine how well they support the deliberate practice of tasks necessary for improved performance.

C. VERIFICATION AND VALIDATION

Verification and validation (V&V) are included in this review in contrast to simulation assessment conducted as part of the USA training effectiveness analysis (TEA) system. V&V are processes that are performed using the most appropriate techniques best suited to the application under study. Verification is understood in many circles to mean the process by which something is evaluated to ensure it is consistent with its specifications. Validation generally refers to the evaluation process used to determine if something satisfies the requirements of its intended customer or user. Validation in the modeling and simulation context is concerned with representational accuracy (i.e., primarily on the model's result) and is guided by the requirements specified by the customer (Petty, 2009). Formal Department of Defense (DOD) definitions for V&V are found in Under Secretary of Defense (2009). It is a formal policy within the DOD that models, simulations, and associated data used to support DOD processes, products, and decisions, undergo V&V throughout their lifecycles (Under Secretary of Defense, 2009).

A distinguishing feature between V&V and the analytical assessment methodology derived as a part of this dissertation is the timing in which they are applied. Within the V&V framework, artifacts that are meant for comparison undergo V&V when they become available. This implies that a tangible item is available for testing and

evaluation. Our methodology views intervention and assessment as appropriate as early on as the training-needs analysis phase and as late as the products delivery.

Feinstein and Cannon (2002), and Sargent (2010) provide information about how empirical TOT studies and various forms of validation are conducted. Knowledge of these two activities provides insight into why training system assessment and V&V of training systems are often viewed synonymously. Both ITE assessment and V&V require valid data. Several analytical and empirical methods designed to assess ITEs require empirically validated data, which has prevented their adoption and use. The failure of these methods will be discussed later in the simulation assessment section.

Reviewing the TOT, simulation assessment, and V&V literature leads us to the conclusion that there are similarities and overlap both mechanically and procedurally between ITE assessment and V&V. The main difference between the two exists in the understanding of the complexity involved with evaluating human performance as opposed to other less dynamic, mechanical and procedural systems. The analytically minded reader may believe that almost anything can be reduced to a series of logical or mathematical models that may be empirically examined. However, there is considerable variability, both within and between human trainees. This variability makes the examination of ITEs that support them much more difficult. Instead of waiting until artifacts are available, early intervention in shaping requirements and identifying critical factors, are better approaches to influencing the validity and utility of integrated training environments.

D. IMPACTS OF SUBJECT MATTER EXPERTS

Reliance on subject matter experts (SMEs) is a mainstay in the training domain. The value of expert opinion and expert reliability in various circumstances has been demonstrated repeatedly (Ericsson, Charness, Feltovich, & Hoffman, 2006) but is not without its limitations (Hubbard, 2009; Marks, Smead, & Alt, 2013). This dissertation is not about expertise or expert performance but it is replete with discussion about the impacts that SMEs have on both the design and evaluation of ITEs. It is likely that there

will always be a role for SMEs in ITE assessment, but SME elicitation must be structured and used carefully with an understanding of its limitations.

1. Positive Contributions

An expert is "a person who has a comprehensive and authoritative knowledge of or skill in a particular area" (New Oxford American Dictionary, 2005). One of the most important points that can be made about SMEs is that they are considered specialists in a certain area and that their expertise does not necessarily transfer to activities outside of that specific area. In other words their expertise is domain specific (Ericsson, 2006). Expertise refers to the characteristics, knowledge and skills held by experts that separate them from other people within the same domain. When used appropriately and within their area of expertise, experts provide valuable support. An example of the appropriate use of a military SME is relying on the opinion of an Army or Marine Corps infantryman in regards to basic rifle marksmanship. Their opinions in this example are appropriate because these service members rely on the rifle as their primary weapon system. Their knowledge of the handling, disassembly/reassembly and operational employment of the rifle certifies them as experts with this particular piece of equipment. However, it would be less appropriate to rely on their opinions as to the appropriate level of visual fidelity necessary in a computerized marksmanship virtual trainer unless they have received a technical education in modeling and simulation. SME opinion and input are used frequently in design, assessment and validation activities.

2. Negative Impacts

Often SMEs are plagued (most unknowingly) by a sociological phenomenon that mistakenly assumes that the role of SME and the role of relative expert are synonymous (Mieg, 2006). More simply put, it is often assumed that working *in* a domain (e.g., training) qualifies one as an expert *of* that domain. Additionally, it is often implicitly assumed that the information obtained from SME elicitation is acceptable (Marks et al., 2013). When these assumptions are false, many of the negative issues previously mentioned occur. SME input is usually sought when time and money for ITE evaluation is limited or when other more empirical means (i.e., TOT studies) cannot be employed.

Research has demonstrated that many SMEs base their estimation of ITE effectiveness on physical device fidelity. It is troubling that these same experts are often untrained in ISD, yet reliance on their opinions is used as the basis for acceptance decisions in multi-million dollar programs.

Marks et al. (2013) suggest that the problems with relying on SME data are caused by elicitation and modeling bias. Elicitation bias may be classified as either motivational or cognitive. Motivational bias occurs when experts do not report their true judgments of a situation whereas cognitive bias occurs when SME judgment does not accurately represent the qualities of interest in a given situation. Modeling bias occurs when an analyst uses flawed or incorrect methods (tool or training bias) to apply SME data to a problem or situation. Modeling bias contributes to the potentially negative impacts of SMEs.

In their review of Sauer and Askren (1978), Muckler and Finley (1994b) reinforce the danger of relying on SME evaluation. They noted the average to poor results of using SMEs to estimate the effectiveness of a training program supporting maintenance training and pointed out the tendency of the experts to overestimate the amount of time required to be trained on a particular skill. Furthermore, their feedback on the impact of equipment on the training program was inconclusive. The problem of overestimation is not unique to the training domain. Hubbard (2009) discusses the problem of "catastrophic" overconfidence in the area of risk management and argues that all humans are overconfident. He suggests calibration training as a mitigation strategy.

3. Recommendation

SME input is critical to various aspects of ITE design (e.g., task analysis, performance requirements). However, a stricter adherence to the spirit of expertise and structure of SME elicitation is necessary. Determining the level of one's expertise prior to their use in validation activities (i.e., Hubbard's calibration idea) ensures that experts are qualified to render judgment, and that their recommendations are at the appropriate level. Utilizing more than one SME (recognizing the limitations of individual SMEs) to provide input on ITE designs prevents a situation where one person's experience is viewed as the

norm for an entire domain. Marks et al. (2013) recommends taking time to develop, screen and test the SME elicitation technique, ensuring that the technique fits the expert(s) rather than forcing the expert(s) to adapt to a specific analysis method. This helps to prevent external factors from directly or indirectly influencing SME judgment. Informing and educating SMEs on other factors impacting the analysis (e.g., trainee differences, ISD/SAT principles) assists in the appropriate application of their judgment and ensures their utility. Blindly accepting SME opinion based on the assumption that they have mastered everything within a domain is as foolhardy as ignoring their input all together.

E. SIMULATION ASSESSMENT

1. Non-Training Domains

Simulation assessment in analytical areas have used methodologies to support the selection of software packages based on surface features (Banks, 1991; Hlupic & Mann, 1995; Law & Haider, 1989). Examination of the simulations has specifically focused on how well the software packages support activities such as analytical decision-making, system acquisition, test and evaluation (Deaver, 1987; Fossett et al., 1991; Gass & Thompson, 1980; Holder, 1990; Tewoldeberhan, Verbraeck, Valentin, & Bardonnet, 2002). Notable emphasis is placed on hardware requirements and characteristics of the hardware such as extensibility, flexibility, graphical support and input and output data, just to name a few. This knowledge is then applied to support simulation acquisition decisions.

Simulation assessment has not enjoyed as much attention as simulation selection in the non-training domain literature (Jadhav & Sonar, 2009; Nikoukaran & Paul, 1999). Given the significant number of features that may be used to describe simulation software, authors have taken the approach of developing and using hierarchies and multiple stage models to describe the essence of their simulation selection methodologies (Jadhav & Sonar, 2009; Tewoldeberhan et al., 2002). In their review of the literature, Jadhav and Sonar (2009) summarized many of the current simulation selection methodologies. They developed and offered a generic stage-based model that adequately

captures the essence of many of the approaches used to select simulation software. While the methodologies developed for selection are useful, some authors have recognized that the methodologies have a misplaced focus. They believe that too much emphasis has been placed on simulation features and not enough on developing a means to evaluate the actual simulation software (Nikoukaran & Paul, 1998, 1999). Despite their focus on features, a subtly stated or implied goal of the various methodologies is to determine the suitability of the software based on the needs of the customer (Hlupic & Paul, 1995; Jadhav & Sonar, 2009; Nikoukaran & Paul, 1998, 1999).

One possible explanation for the focus on surface features and emphasis on selection might be found in the way that simulations are viewed and characterized in non-training domains. Here, simulation is a tool that is viewed as being in one of two classes: simulation languages or simulators (Azadeh, Shirkouhi, & Rezaie, 2010; Hlupic & Paul, 1995, 1996; Law & Haider, 1989; Nikoukaran & Paul, 1999; Nikoukaran, Hlupic, & Paul, 1998, 1999). Banks (1991) includes spreadsheets and rapid modeling tools in his discussion of classes but mentions that these tools are for smaller tasks and that they are limited compared to languages and simulators. Simulation languages are viewed as being useful to develop models and programs. They require more expertise but are more flexible. Simulators are built to serve a specific or range of specific purposes. They do not solve every possible problem. As Nikoukaran and Paul (1999, p. 2) describe them, simulators are “like a toolbox containing a limited number of different tools and maybe some flexible ones.” With this in mind, we now have better insight as to why features of simulations are focused upon by analytical users rather than their impact on the organization or individuals using them. Surface features can be linked, traced or identified as necessary to address aspects of specific challenges. Within this domain, simulations are used to support problem analysis and modeling, problem solving, decision-making, and situational understanding, but not the training of personnel to execute work or tasks.

Jadhav and Sonar (2009) highlight several pieces of literature that attempt to evaluate simulations within the manufacturing domain and other analytical areas. While evaluation was in the title of these works, none of them described any methodology to

evaluate the *performance* of the simulation. Rather, they evaluated simulation package features using various analytical means such as applying

- Criteria and criteria weighting (Tewoldeberhan et al., 2002)
- The analytical hierarchy process (Davis & Williams, 1994)
- Fuzzy set theory combined with the analytical hierarchy process (Azadeh & Shirkouhi, 1995)
- Fuzzy set theory combined with multi-criteria decision theory (Cochran & Chen, 2005).

While most of these additional steps added valuable rigor in the decision-making process for selecting a package, none of them evaluated a simulation. All of the evaluation methodologies reviewed use the same basic structure borrowed from the selection literature of identifying and prioritizing the important features of the simulation software for the customer. None of the evaluation techniques discover or determine how well the simulations perform; rather, they support the activity of choosing a package. This makes them largely unsuitable for use in evaluating a simulation designed to enhance human performance or knowledge and skill acquisition.

2. Within a Training Domain

Several meta-analytic reviews investigating the state of the art in analytical ITE assessment have been conducted (Muckler & Finley, 1994a, 1994b; Simpson, 1995; Tufano & Evans, 1982; Wheaton et al., 1976). These reviews indicate that since about 1960, various forms of training and cost effectiveness models and programs to assess ITEs have been developed and implemented. While many of the efforts had merit and some demonstrated their usefulness in various contexts, few if any of them are currently used despite their advantages. Reasons given for not using the models include their complexity, extensive empirical data requirements, and costs in time and money to run and maintain. Many of the analytical methods developed do not have adequate and complete public documentation or software algorithms, which makes their implementation almost impossible. Changing service priorities and lack of acceptance round out the list of reasons why ITE designers do not use training estimation models (Morrison & Hammon, 2000; Muckler & Finley, 1994a; Simpson, 1995).

From the reviews, Simpson (1995) concluded that the training domain needed to work to produce guidance on how to develop and describe method selection, methods and case studies in support of DOD's cost effectiveness analysis of training (CEAT) efforts. In Simpson's (1995) view, much was done to develop various methods to determine ITE effectiveness but guidance on how to conduct ITE analysis was missing. Simpson (1999a, 1999b) provide guidance to help analysts design meaningful training effectiveness evaluations (TEE). The two volume document describes procedures for alternative methods of conducting TEE and provides examples of TEEs that may be used for emulation (Simpson, 1999a, 1999b). Despite Simpson's (1999a, 1999b) efforts, there is no indication that the development of what Simpson called "CEAT methods" was accomplished.

Models and simulations are used in the training domain to create ITEs. Assessment of those ITEs is linked to knowledge and skill acquisition and human performance. Gorman (1991) categorized simulations as being in one of three groupings: (a) constructive (b) subsistent or (c) virtual. Currently, the DOD describes simulations as live (Gorman's subsistent), virtual and constructive. Games have been added in recent years to account for the increased use of commercial off-the-shelf (COTS) computer gaming technology in support of training. Current definitions for live, virtual and constructive simulation found in Under Secretary of Defense (1998) are

- Live—simulation involves real people operating real systems
- Virtual—simulation involving real people operating simulated systems and
- Constructive—models and simulations that use simulated people operating simulated systems.

Under Secretary of Defense (1998, p. 133) elaborates on its definition of constructive simulation with "real people stimulate (make inputs) to such simulations, but are not involved in determining the outcomes." The term hybrid simulation is also defined in Under Secretary of Defense (1998, p. 125) as "a simulation that combines constructive, live, and/or virtual simulations, typically in a distributed environment. Such simulations typically combine simulators with actual operational equipment, prototypes

of future systems, and realistic representations of operational environments.” While “hybrid” is typically used to describe what we refer to as ITEs, the definition is neither as specific nor as inclusive as ours.

Morrison and Hammon (2000) discuss what they call large-scale training simulations (LSTS). They categorize LSTS by saying that LSTS provide a wide array of support to training and readiness assessment including the ability to rehearse missions, support both collective and individual training, and performance assessment. Morrison and Hammon (2000) point out that the size and complexity of LSTS distinguish them from other simulation based training systems. LSTS include robust content and support a large number of possible training objectives. Given their size, all attempts to determine their effectiveness must be expansive as well. We believe that our definition of ITEs includes LSTS appropriately.

Considerable work has been attempted to assess the impact of various training-aids, devices, simulators and simulations (TADSS) that make up ITEs designed to improve human performance and skill acquisition. Prompting research are statements like those made by Smode and Hall (1975) lamenting on the meager amount of data supporting device evaluation and TOT. The lack of data supporting device evaluation, intuition, and uneven research results, has resulted in an overreliance on engineering facsimiles as the basis for ITE design decisions.

Often, researchers have attempted to assess the value of training and TADSS through the use of empirical means such as TOT studies or formal technical system evaluations, believing that these provide the best evidence of effectiveness (Salas et al., 2008; Simpson, 1995). In their review of training from 1990 to 2000, Salas and Cannon-Bowers (2001) point out that more empirical training-related research exists now than ever before and that the money spent on training evaluation varies between $55 and $200 million dollars annually. These empirical types of activities are difficult to conduct however, during periods of decreasing resources (e.g., Burnside, 1999; Dawdy & Hawley, 1982; Simpson, 1995; Sticha et al., 2002).

For many reasons, effective evaluation of human performance and ITEs continue to elude us. Salas and Cannon-Bowers (2001, p. 487) provide insight: “training evaluation is one of those activities that is easier said than done. It is labor intensive, costly, political, and many times is the bearer of bad news.” Sticha, Campbell, and Knerr (2002) surmise that a large part of the problem is due to the lack of organization of the research. The disorganization has resulted in a failure to produce specific methods to assist in the selection of virtual environment (VE) solutions, guide their development, or assist in evaluating their effectiveness. Usually, researchers approach the determination of ITE effectiveness by assessing task performance and the behavioral processes and outcomes, which have previously been noted as difficult at best. In many cases, these items cannot be measured and so analysts rely on subjective estimates of ITE capabilities. These subjective estimates are often provided by SMEs who are untrained and ignorant of training program design theory and practice (Morrison & Hammon, 2000).

Efforts to develop better and less expensive approaches to assess ITE performance have resulted in non-empirical methods to evaluate ITEs. (Burnside, 1990; Gilligan et al., 1990; Keesling et al., 1999; Nolan, 2007; Sticha et al., 2002). Use of analytical methods for assessment is important because it is the only way to evaluate a system that does not yet exist (Morrison & Hammon, 2000; Simpson, 1995). While this statement seems intuitive, it is a key point worth expanding further. ITEs generally take years to design, manufacture and field. During that time, as a part of the system engineering process, iterative test, verification and validation of components goes on, but it is not until an ITE is fielded and formally tested that the customer truly learns the ITEs capabilities or usefulness.

More recent research in training assessment conducted by Durrani, Geiger, Jones, Hale, and Street (2008) has proposed a statistical approach to evaluate ITEs based on knowledge and skill transfer. Durrani et al. (2008) focuses on physical and neuropsychological cue mismatches between the real and simulated environment as a way to evaluate ITEs without extensive empirical study. While interesting, their method is too difficult to implement by the training developer (TD). Darken (2009) has taken a different approach and proposed binding ITEs by identifying their strengths, weaknesses

and limits based on the human abilities they support with a goal of determining what specific tasks an ITE is best suited for. His proposal was influenced by the work of Cockayne (1998), who investigated the use of human abilities on one-hand and whole hand human performance in a virtual environment setting.

A series of research studies sponsored by ARI provide the most relevant attempts to analytically determining the usefulness of ITEs (Burnside, 1990; Jacobs, Crooks, Crooks, Colburn, Fraser, Gorman, et al., 1994). The studies employ an analytical methodology developed by Burnside (1990) referred to as the task performance support (TPS) code approach. The TPS code approach leverages the standards, tasks, and subtasks from mission training plans (MTPs) along with subjective ratings and decision rules to determine ITE effectiveness. The TPS code approach was applied to investigate the Simulation Networking (SIMNET) programs ability to satisfy training requirements as outlined by the MTPs for both mounted and dismounted armored elements. In Burnside's (1990, p. 23) own words "the method described in this report provides a comprehensive approach to assessing the capabilities of *existing training devices and simulations"* [emphasis added]. Burnside (1990) does not attempt to address the development of new systems. Sticha et al. (2002) extended Burnside's (1990) TPS code approach through the development of the Specified Training Requirements in Virtual Environments (STRIVE) approach. STRIVE was used to evaluate the follow-on program of record to SIMNET called the Close Combat Tactical Trainer (CCTT). The goals of STRIVE were to "develop a method for evaluating the capabilities of virtual simulation to represent the tasks and missions within a given military application domain, to demonstrate the methods in two domains, and to propose ways to integrate the method with existing doctrine" (Sticha et al., 2002).

Muckler and Finley (1994) reviewed 36 system estimation models. They noted that the definition of 'system' was narrowly focused and that most models they reviewed were only concerned with a training device or other media while leaving out other critical factors of the training program. During their discussion, Muckler and Finley (1994) emphasized the point that within this research area, "state of the art" has largely been a learning experience. The seeds of future innovations have been planted, the models

developed and lessons learned were necessary in order to prepare the field to understand the problems and possible future directions. They offered that “state of the art” has deficiencies that provide research opportunities, but also strengths that should be exploited.

Two strong conclusions can be drawn from the literature that support the current effort—*increasing the use of empirical methods to evaluate ITE effectiveness is infeasible, and sound analytical methods must be developed and employed, even though it is recognized that these analytical methods are not as scientifically rigorous as their empirical counterparts* [emphasis added] (Hays & Singer, 1988). Within the training domain it is apparent that efficient and cost effective methods to evaluate ITEs are necessary. There is evidence to support the assertion that it is possible to quantitatively predict and evaluate alternative options to support training before ITEs are developed. The task that remains is to convince the training development community that some of the analytical assessment models do work and that they can be useful in supporting ITE development and assessment (Muckler & Finley, 1994). Some believe that sound analytical methods supporting development and assessment would be employed if placed into the hands of the appropriate users. To be effective, the methods must be designed so that they are easy to use and flexible enough to support both the training and engineering sides of system development (Rose et al., 1985).

F. TRAINING EFFECTIVENESS ANALYSIS (TEA) SYSTEM

1. Overview of the TEA System

The purpose of this section is to introduce the reader to what formerly was known as the USA Training Effectiveness Analysis (TEA) system. This overview is included to inform the reader of the Army’s expectations concerning the analysis conducted in support of developing and existing ITEs and training programs. Previously, studies were executed in an attempt to ensure that effective training products were fielded to the soldier and that alignment with the material acquisition process (MAP) was maintained. With the rescinding of *TRADOC Regulation 350-32, the Training Effectiveness Analysis (TEA) System*, program managers (PMs), training developers (TDs) and material

developers (MDs) now bear the responsibility for ensuring that proper evaluation and analysis of ITEs and training programs are conducted.

The USA TEA system was formally established in 1975 as a Training and Doctrine Command (TRADOC) program focused on the impacts associated with training and hardware costs, hardware development cycles and complexity, training resources, and the overall effectiveness of Army programs to prepare soldiers for battlefield conditions (Neal, 1982). Prior to 2012, the TRADOC Analysis Center at White Sands Missile Range (TRAC–WSMR) was the Army's lead agency for providing technical assistance and conducting TEA for training systems. *TRADOC Regulation 350-32* governed the TEA program. All TEA studies that were conducted were captured in formal reports that were provided to the initiator of the study and ultimately ended up in the Defense Technical Information Center (DTIC) library.

2. TRADOC Regulation 350-32

According to *TRADOC Regulation 350-32, the Training Effectiveness Analysis (TEA) System* (rescinded), TEA studies were the primary means by which TRADOC established and maintained quality control over products of training development and training delivery systems Training and Doctrine Command, 1994). Initially, the TEA system focused on a medley of cost, operational effectiveness and human factors assessment methods. The TEA system had many objectives but the ones of most concern to this research are to:

(a) Evaluate and improve training development and training delivery systems by determining the effectiveness of training programs and products fielded or implemented

(b) Determine the effectiveness of training innovations (i.e., new training technologies) that hold promise for resolving difficult training problems or improving existing training programs and

(c) Assist in meeting training requirements through assessing training impacts, comparing alternative training strategies, and evaluating effectiveness of training solutions. (Training and Doctrine Command, 1994)

The TEA system focused mainly on cost and effectiveness and was one of many categories of studies used to inform resourcing decisions. *TRADOC regulation 350-32*

(rescinded) stated that no two TEA studies were the same and that ultimately it was the organizational entity and proponent for the study who would determine the quantitative or qualitative nature and focus of the assessment (Training and Doctrine Command, 1994). In order to be effective, the TEA system exhibited the characteristics of centralized management, evaluative responsiveness over the life cycle of a program, deployment of interdisciplinary methods of evaluation, an independent evaluation philosophy and a focus on empirical data.

Prior to being formalized, training and cost effectiveness studies went by various names (Training and Doctrine Command, 1994). The TEA system consolidated these various studies under one umbrella called "TEA" to facilitate efficiency within the program. *TRADOC Regulation 350-32* (rescinded) organized TEA studies into one of three categories. (1) Those related to system acquisition designed to evaluate the effectiveness of new systems and coincide with system acquisition decisions; (2) Those used to evaluate current systems, which investigate the effectiveness of current training programs and investigate possible alternative approaches and technology solutions; and (3) Those executed with the intent of improving training study methods. This last grouping of TEA studies was executed with the goal of strengthening the overall TEA program (Training and Doctrine Command, 1994).

Execution of TEA was directed to coincide with the various phases of the material acquisition process (MAP). TEA studies were numbered so that they could be associated with the corresponding phase of the MAP. For example, TEA–1 was executed during MAP phase 0 with a focus on supporting operational requirements document (ORD) development. Critical tasks to be trained, the methods available to train these tasks, and the critical training issues that needed attention during the acquisition process were identified during TEA–1 (Training and Doctrine Command, 1994). TEA–2 were executed during MAP–1 and generally built on the recommendations of TEA–1 studies. According to TRADOC, "Early TEA establish and define the training device requirements and costs, while later TEA refine and update this information. They provide supporting documentation for the TADSS ORD and ORD updates" (Training and Doctrine Command, 1994, p. 7). Post fielding TEAs (PFTEA) generally, were conducted

12–24 months after system fielding or program implementation, to ensure that the ITE/program had settled into a steady state before evaluation began.

TEA methodologies were never standardized and were often determined by the current state of ITE development and the study organizer. Although *TRADOC Regulation 350-32* (rescinded) set guidelines for the conduct of TEAs, it acknowledged that a single best method did not exist for measuring ITE effectiveness. Evaluator focus and questions were meant to determine which approach should be taken to evaluate an ITE. According to TRADOC, "Issues addressed by TEA for resolution of training problems are study specific. They are related to questions of training impact, cost effectiveness, training effectiveness, and training transfer" (Training and Doctrine Command, 1994, p. 10). In addition to quantitative methods, TEA studies included other diverse methods, such as qualitative analyses, field observation, task analyses, survey research, and questionnaire design and analysis.

TEA studies provided insights, feedback and analysis to TDs and MDs on prototype systems, processes and designs that informed training program and ITE development and trade-off decisions at all levels of the ISD/SAT process. Additionally, these studies provided an audit trail during ITE development that impacted evaluation, analysis and design of training program and ITE alternatives.

3. User View of the TEA System

Years after the TEA system was initiated, several authors provided reviews and examples of the TEA system in action (Neal & Paris, 1985; Maitland 1982; Carter 1982). Interestingly, these discussions all happen to coincide between the years of 1982 and 1985. Speculation over why there are not more reviews and discussion of the TEA system are not entertained here. From the available reviews, it is observed that authors have sometimes categorized the TEA process as a systems approach for assessing ITE effectiveness (Neal & Paris, 1985). Simpson (1995) concluded in prior research on cost effectiveness analysis that the Army had the most "comprehensive guidance" related to executing TEA studies. He and others have emphasized that the regulations and guidance are explicit on when to conduct analysis but they are much less clear about how to

conduct them (Carter, 1982; Maitland, 1982; Simpson, 1995). In his paper, Maitland (1982) provides information and an example of how one TEA was conducted in support of the USA's M1 (Abrams) Main Battle Tank Operational Test. Carter (1982) provides an example of an attempt to provide standardization to the TEA study process. Carter (1982) also highlights that people typically tasked to conduct TEAs are not educational technologists and the lack of detailed guidance on how to conduct TEA is a threat to the accuracy of the evaluations. A TRADOC TEA handbook was drafted in 1980 yet it was never formally published as such (Matlick, Berger, & Rosen, 1980). Simpson (1995, p. 56) noted that "the impression given is that the material was intended for use as a cookbook for performing TEA by an audience that lacks sophistication in the area." He further believed that trying to replace the experience and skills obtained through higher level graduate education in analysis, experimental design and experimentation with a handbook, would be regarded skeptically by experts outside of the DOD.

Neal (1982) and Neal and Paris (1985) in their discussions of TEA studies, suggested that comprehensive TEAs have to focus on five factors: (1) the soldier (2) the trainer (3) the training subsystem (4) the hardware subsystem and (5) the training environment. They discuss that TEA studies often provide the first opportunity to gain insight into characteristics that will be important in both personnel selection and in the development of trainer and leader characteristics necessary for developing soldier knowledge and influencing skill acquisition. They continued by saying that investigating and understanding the design, development and conduct of a training program, the devices employed and any other contributing products, provides insight into the most significant contributors to skill and knowledge acquisition that are clearly key in TOT.

Neal and Paris (1985) further elaborated on the need to analytically assess novel ITEs and training program approaches early in their development, when empirical comparisons are not practical. This need resulted in the development of judgmental techniques using SMEs to assess ITE and training program alternatives. The use of analytical techniques that influence and lead to effective ITE design and implementation of training programs are critical during periods of decreased resources. When employed, these techniques prevent design flaws that complicate the training process or possibly

reduce design-induced training effectiveness problems. In wrapping up their remarks on the five factors, Neal and Paris (1985) discuss the organizational environment and the many other factors (i.e., policies, regulations, customs, priorities, perceived importance, training resources, personnel availability and turbulence, resource allocations, geography, weather, climate, etc.) that can impact training effectiveness. They suggest that by applying the proper focus during a PFTEA, the organizational factors affecting training effectiveness can be identified and assessed (Neal & Paris, 1985). Viewed from outside of the USA, this five-factor approach appears to closely resemble several of the training input factors considered when investigating TOT.

Dawdy and Hawley (1982) describe and discuss what they believe are the nine major phases of a TEA, the first six of which they describe as preliminary yet essential to the training effectiveness and cost evaluation that follows them. The phases are

- Identification of missions, functions, and tasks
- Selection of tasks for training
- Task analysis
- Generation of course structure
- Development of training program alternatives
- Development of extended program of instruction
- Analysis of training effectiveness and trainability
- Determination of training program costs
- Cost and training effectiveness trade-off analyses.

The first three phases are focused on in this research and provide a means to refine our analysis and identify ITE gaps. Dawdy and Hawley (1982) highlight that often the experimental determination of program effectiveness is not possible, which leads to the use of analytical measures of assessment and SMEs.

Practitioners of TEA recognize that the world is not perfect and that many influences have negative impacts on an organizations ability to properly conduct analysis. Simpson (1995) points out that the most significant impacts are time and money. He asserts that time affects TEA significantly and believes that there is an incentive to conduct TEA studies early in the program lifecycle. That incentive includes the

opportunity to save money and to identify needed program and ITE changes early on. However, Milham et al. (2008) point out that PFTEAs are most notable type of TEA conducted. They acknowledge that these post fielding studies are valuable but support Simpson (1995) by indicating that the late evaluation decreases the impacts that the results of the evaluation can have on changing a system. Figure 5 provides the reader with an appreciation of the effects of time, cost and the availability of training data during ITE development. Simpson (1995) adds that unit availability, participant training level and willingness to cooperate, and analyst experience also are significant factors that impact or limit the type and kind of TEA that may be feasibly executed.

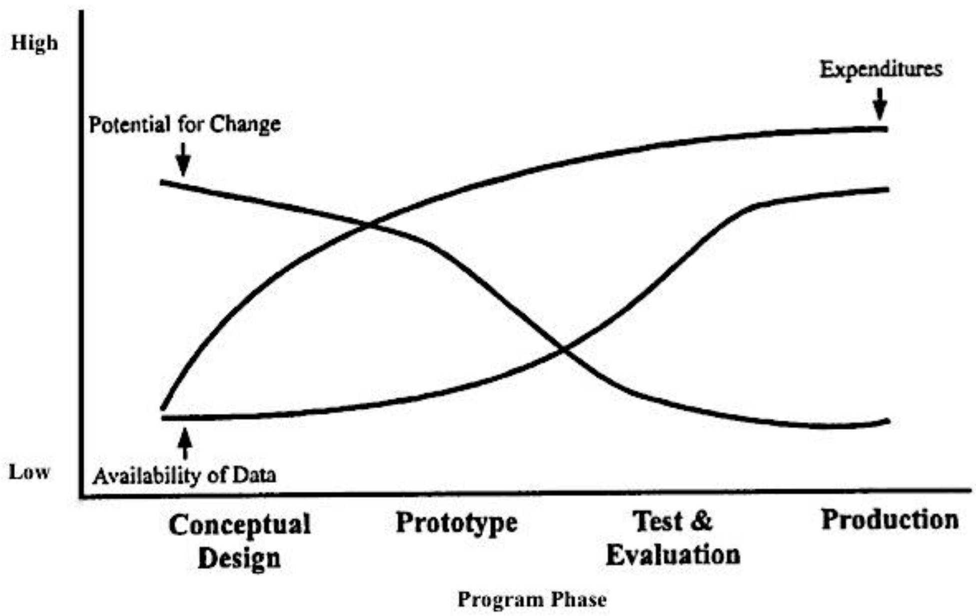

Figure 5. Relationships among expenditures, data, and potential for change of an ITE during the acquisition lifecycle (from Simpson, 1995, p. 24)

4. Conclusion

The USA established a mechanism to provide analysis of training programs with the instantiation of the TEA system in 1975. Simpson (1995) offered that at that time, the Army system was the most robustly defined training analysis system that existed. System analysts (e.g., Carter, 1982; Maitland, 1982) described the use of TEA studies for the benefit of their respective programs and went a step further to offer examples of how to

conduct TEA studies. Others (e.g., Dawdy & Hawley, 1982) have provided additional insight in how to conduct ITE analysis and what aspects of analysis were most important. Yet, in the summer of 2012, the USA officially concluded its last TEA study, eliminating both the office responsible for the conduct and oversight of TEA, and the regulation that governed the TEA system. Simpson (1995) described a TEA program as having three elements (i.e., the service promulgates in writing the requirement to perform TEA; an organization exists that is formally tasked with performing TEA; and the service publishes TEA reports). While we acknowledge that training effectiveness studies are still being conducted, we are able to assert based on Simpson (1995) alone, that the USA no longer has a TEA program.

G. SUMMARY

State of the art is normally understood to mean the condition of a field of research or technology at the present time. In the field of ITE effectiveness evaluation, Muckler and Finley (1994) stated that their summary of the literature revealed:

> Two decades of exploratory development have resulted in a collection of mostly unconnected and uncoordinated quantitative models. In one sense, the accumulated 'state of the art' has provided a large learning experience from which many major future advances may be possible. A point of view is that the past two decades were necessary to structure and to begin to understand the problem. (Muckler & Finley, 1994a, p. 26)

If this was the case in 1994, then what can we say about today? Much has been learned but we have not yet fully addressed all of the problems that have been identified. The preceding literature review provides the reader with two important prerequisites to this research: (1) background in the areas that are pertinent to the current research effort and (2) insight into the relationships between the important aspects of task analysis, human abilities and affordance theory that will be used for developing an analytical assessment methodology for ITEs. This review covered many topics that play central or supporting roles in the development of ITEs. We wish for the reader to have an appreciation of the complexity of the assessment problem (e.g., fidelity, front-end analysis, levels of TOT, SME input etc.) and the implications of failing to understand the importance of the topics provided in the literature review.

In summary, literature dealing with various aspects of the training domain has been presented. The impacts of not conducting proper front-end analysis were reviewed and the pitfalls of misusing fidelity as an assessment technique were discussed. The positive and negative impacts that SME input imposes on system design and evaluation were revealed. The literature reveals that SMEs tend to over rely on physical fidelity, usually without any real understanding of the other important pieces of ISD/SAT. An introduction to human ability research was presented and its linkage with TA in the current research was provided. Affordance theory was introduced and its linkage with ITE fidelity and human abilities was offered. Examples were provided to help the reader gain an understanding of affordances and their ability to indicate possible gaps in task performance within an ITE. A review of the TOT literature was provided, reinforcing many of the points previously made dealing with front-end analysis and assessment. A brief introduction and coverage of V&V was conducted that provided knowledge about the similarities between V&V and TEA. The literature reviewing forms of analytical simulation assessment both in and outside of the training domain was discussed. This review provided knowledge of the efforts executed to date in the field of simulation assessment and demonstrated the uniqueness of the proposed approach in addressing utility estimation of ITEs. To close the chapter, we introduced the reader to the USA's Training Effectiveness Assessment (TEA) system, which, prior to closing in 2012 provided the organization (policy, guidance, and manpower) to conduct ITE and training program assessment.

The need for guidance on how to assess ITEs is real. The need to employ a methodical process that carefully considers many of the factors discussed in this section is clear. The problems with existing analytical models designed to measure training effectiveness have been noted. Our goal is to develop a flexible yet defined methodology that addresses the important aspects of ITEs by focusing on task analysis, human abilities, and affordances. We believe that by using these three components in symphony, information about the proper amount of fidelity and TOT will be illuminated for the ITE stakeholder. We hope that we are able to move towards what Muckler and Finley (1994) called simpler models that ask and answer simpler questions.

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III. INTEGRATED TRAINING ENVIRONMENT ASSESSMENT METHODOLOGY

The integrated training environment assessment methodology (ITEAM) is a human-centered systems engineering approach to the analysis of integrated training environments (ITEs). ITEAM was developed based on the lessons learned from the literature and on the recognition that front-end analysis is critically important to training system development. Of the pieces of a training program (i.e., technology, requirements, humans) it has been established that computer technology evolves the quickest (i.e., Moore's law). Requirements determination takes place at a much slower pace. Human beings evolve the slowest yet their evolutionary stability is ignored in training program development in favor of an emphasis on technology. ITEAM takes this into account by recognizing that human trainee not the technology should be the bedrock of ITE development.

ITEAM demonstrates value as a process that encompasses ITE requirements definition, verification, and assessment. As a requirements definition process, ITEAM focuses the discussion of ITE development squarely on performance shortfalls in terms of tasks and the human abilities necessary to execute those tasks. When used for requirements definition, ITEAM provides support to those attempting to visualize an ITE and how the ITE might support training. Articulation of the vision, in terms of tasks, abilities and affordances provides a base of necessary information used for ITE verification. Execution of the methodology to its end, allows users to conduct a sanity check on the level of support the ITE ultimately provides through the comparison of affordance requirements and available affordance resources. The use of a quantitative and qualitative scoring technique provides the evaluator and user with a way to gain insight into how well the ITE supports the deliberate practice of skills for specific tasks.

Useful evaluation of an ITE is dependent on a clear articulation of the need for the ITE, an understanding of what the ITE will provide/support, and a clear statement of the desired measurable performance outcomes. Training program context is important. Understanding where and when an ITE will be used in the context of the training

program assists in determining the functional allocation between the user and the ITE. Figure 6 depicts the ITEAM model. The reader should approach the methodology beginning with the process described as “determine need” and move from left to right to “determine real world affordances.” From there the reader should step to “determine ITE human abilities” and move from left to right to “determine ITE affordances.” Finally, the reader should step down to “assess ITE level of support.”

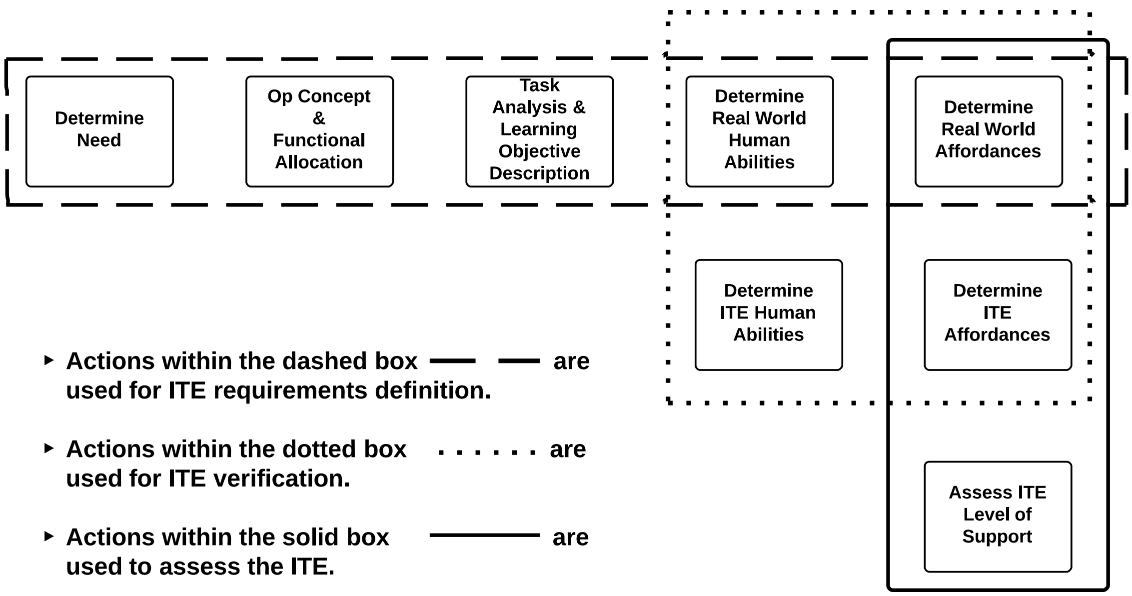

Figure 6. Integrated training environment assessment model

The next section breaks down the model and describes the processes and sub-processes of ITEAM. Several sub-processes of ITEAM are used more than once within the model. To avoid confusion, each sub-process is only described once. Each of the sub-processes is driven by questions that, when answered, provide the necessary details for the methodology. Appendix B provides the reader with examples of the questions asked during each of the sub-processes.

A. DESCRIPTION OF THE ITEAM PROCESSES

1. Requirements Definition

The processes involved in defining and determining the requirements for an ITE are depicted in Figure 7 and proceed from left to right. For existing ITEs, this process is used to determine what the ITE should contain to support the deliberate practice of specific tasks. For ITEs in development, this process may be used to systematically determine what should be included in the ITE specification to facilitate transfer of training.

Figure 7. ITEAM requirements definition process and sub-processes

a. Describe the Operational Need, Capability or Performance Shortfall in Terms That are Specific and Measurable

This sub-process requires several iterations and should result in an unambiguous statement that defines and pinpoints the problem that needs to be addressed. The sub-process provides insight into the development of an operational concept for the ITE and ideas of how performance improvement will be quantified.

b. Determine and Describe the ITE Capabilities Using an Operational Concept and Functional Allocation

This is the first step in determining how the ITE will support the need and provides insight into what human abilities will be involved in the ITE. This sub-process helps illuminate where the ITE may best be utilized in the training program. At the conclusion of this sub-process, a clear delineation should exist of what things the trainees will do and what support the ITE will provide to the training program and trainee.

c. Conduct a Job/Task Analysis of the Real World Activity to Identify the Critical Tasks Needed to Accomplish the Desired Learning/Training Objectives

This sub-process should not terminate until the level of detail is appropriate and addresses the performance shortfall. The sub-process supports the development of or refinement in the learning objectives associated with the training and the POI. The goal of this sub-process is to describe the tasks to a level of detail that supports identification of the human abilities associated with the tasks.

d. Annotate the Job/Task Analysis with Human Ability Requirements Associated with the Tasks

After the critical tasks and subtasks for job/mission success have been identified they should be annotated with the appropriate human ability requirements associated with them. All applicable abilities from each of the four categories (cognitive, sensory, psychomotor, physical) should be listed by task/subtask to ensure a complete human description of the evaluated activity.

e. Determine and Describe the Necessary ITE Affordance Requirements Based on the Identified Human Abilities

This sub-process should initially be approached broadly. An appropriate level of detail is reached when the affordance descriptions are rich enough to support a full understanding of the types and kinds of things necessary for real world execution of the tasks. Affordance descriptions should avoid specifying distinct solutions. The information yielded from this sub-process supports the design, development and assessment of the ITE hardware and software.

2. Verification

The verification process is used to compare the requirements for supporting task execution with the resources available within the ITE. Figure 8 depicts the sub-processes involved in ITEAM verification. The verification process begins with determining the

real world requirements for both the human abilities and affordances. It then examines the ITE to determine the human abilities supported by the ITE and the affordance resources available within the ITE.

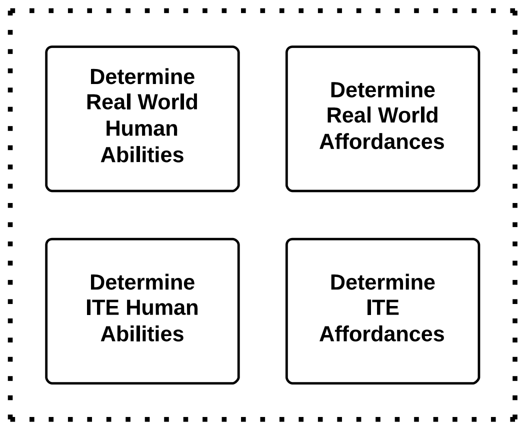

Figure 8. ITEAM verification process and sub-processes

a. Determine What Human Abilities the ITE Supports Compared to Those Necessary to Execute the Real World Tasks

In this sub-process, an examination of the ITE is conducted to determine what human abilities the ITE directly and indirectly supports. The examination identifies the qualities of the ITE that enhance or detract from task performance. Initially this is where a determination is made as to whether or not the ITE supports the deliberate practice of the tasks and in what form the support takes (i.e., cognitive, sensory, psychomotor or physical).

b. Determine the Affordances Present in the ITE

This sub-process examines the ITE in an attempt to determine if the ITE contains the affordances that were previously identified as being necessary for real world execution of the tasks. An inventory of all of the characteristics of the ITE occurs and is initially guided by the real world affordance requirements list. The affordance inventory should not be constrained by the real world list; rather it should address all of the affordances available within the ITE.

3. Assessment

Figure 9 depicts the assessment process and sub-processes involved ITEAM. The final process of assessment leverages the affordance requirements developed during the requirements definition process and the affordance resource inventory from the verification process. Those two pieces of information are compared and scored to determine the ITE's level of support for the deliberate practice of specific tasks. This process is used to assess the ITEs potential support to training.

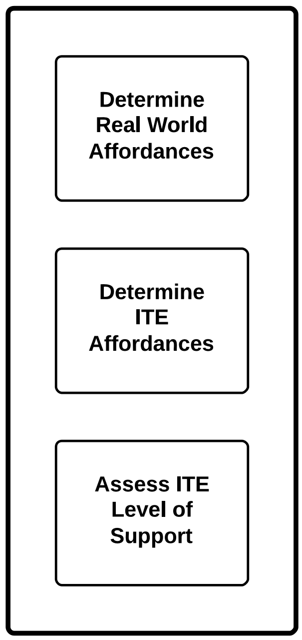

Figure 9. ITEAM assessment process and sub-processes

a. Quantify the Level of Support the ITE Provides to the Training Audience

This sub-process allows SMEs and others who are knowledgeable about task execution and the requirements of the operational environment to determine the quality of support provided by the ITE. This determination is based on the presence of necessary affordances. The process begins with a comparison of the affordance requirements and affordance resources. The process ends with a qualitative statement of the expected level of ITE support to the deliberate practice of the specific tasks.

The next section provides details on how affordances are scored and how the overall rating of ITE support for the deliberate practice of tasks is developed.

B. SUBTASK AFFORDANCE SCORING

The scoring of ITE support to the deliberate practice of tasks is conducted in the following manner. ITEAM uses a five point ordinal scale with non-dichotomous values in conjunction with a ratio scale to determine the level of affordance presence within an ITE. The same scale is also used to rate the level of support the ITE provides to deliberate practice of tasks. Figure 10, depicts the ITEAM scale. In its current form, ITEAM scoring treats all affordances equally. Incorporation of a method to weight affordances based on stakeholder requirements is recommended as an area for future work.

Scale Definition

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Figure 10. Definition of the measurement system used in ITEAM

The rating scale was purposely skewed to ensure that ratings of excellent would not be common. We set up the scale so that the first two scoring levels (Poor and Fair) each contain 25 percent. The next two scoring levels (Good and Very Good) each contain an additional 20 percent and the final scoring level (Excellent) contains only 10 percent. Constructing the scale in this manner provided a progressive level of difficulty in reaching a rating of excellent, which requires that an ITE contain 90 percent or better of the affordances identified as being required to support the deliberate practice of specific

tasks. Furthermore, the rating categories are used mainly for coarse comparisons. When we claim that ITEAM was able to predict an outcome from a TOT study, we use the number score, not just the category.

1. Subtask Affordances are Unique

A unique affordance is one that has not been previously evaluated or accounted for as part of another subtask evaluation. Figure 11 depicts one example of an analysis conducted that contained only unique affordances.

Real World (RW) Preconditions: Trainee has been issued a mission order and understands his AO and AI; Trainee is familiar with troop leading procedures, mission analysis and METT-TC; Trainee has conducted steps 1 and 2 of the troop leading procedures			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Conduct a terrain analysis from a map and materials provided by the higher headquarters using the acronym OAKOC (Obstacles, Avenues of Approach, Key Terrain, Observation and Fields of Fire, Cover and Concealment).	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Memorization **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Paragraph 1 of OPORD that provides information from higher headquarters about the terrain and weather. – Representation of the terrain that the trainee will maneuver over (e.g. map, aerial photographs) – Intelligence information about enemy emplaced, natural or man-made obstacles known by the higher headquarters – Maneuver Combined Obstacle Overlay from higher headquarters	**COGNITIVE:** **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor allows for as much or as little detail as desired in paragraph 1 of the OPORD. – Scenario editor allows for as much or as little detail as desired with respect to intelligence information – Scenario editor allows maps and simulated photography to be provided in the scenario. – No MCOO functionality exists in the game	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor 3 of 4 present
Trainee repeats analysis as necessary to maintain a current assessment					
Post conditions: Answer provided to question: What is the terrain's effect on the operation?; Graphical Terrain Analysis Overlay (GTAO) developed; Information that will support the development of his tactical plan is available					

Figure 11. Example of analysis with unique affordances

If a subtask's affordances are unique, then a simple average of the number of affordances present divided by the total number required provides the percentage of affordances available for the subtask. This percentage is compared to the rating scale (Figure 10) and results in a rating of 1–5 Poor to Excellent. For the example in Figure 11, the task requires four affordances and the evaluation determined that the scenario editor covers three of the four. The fourth required affordance is not present nor does the system have the capability of providing it. In this case we have three of four required affordances.

When we divide three by four we recognize the result to be 75 percent. Referring to the scale in Figure 10 we determine that 75 percent presence equates to a rating of 4–Very Good. Figure 12 depicts the process to score unique affordances.

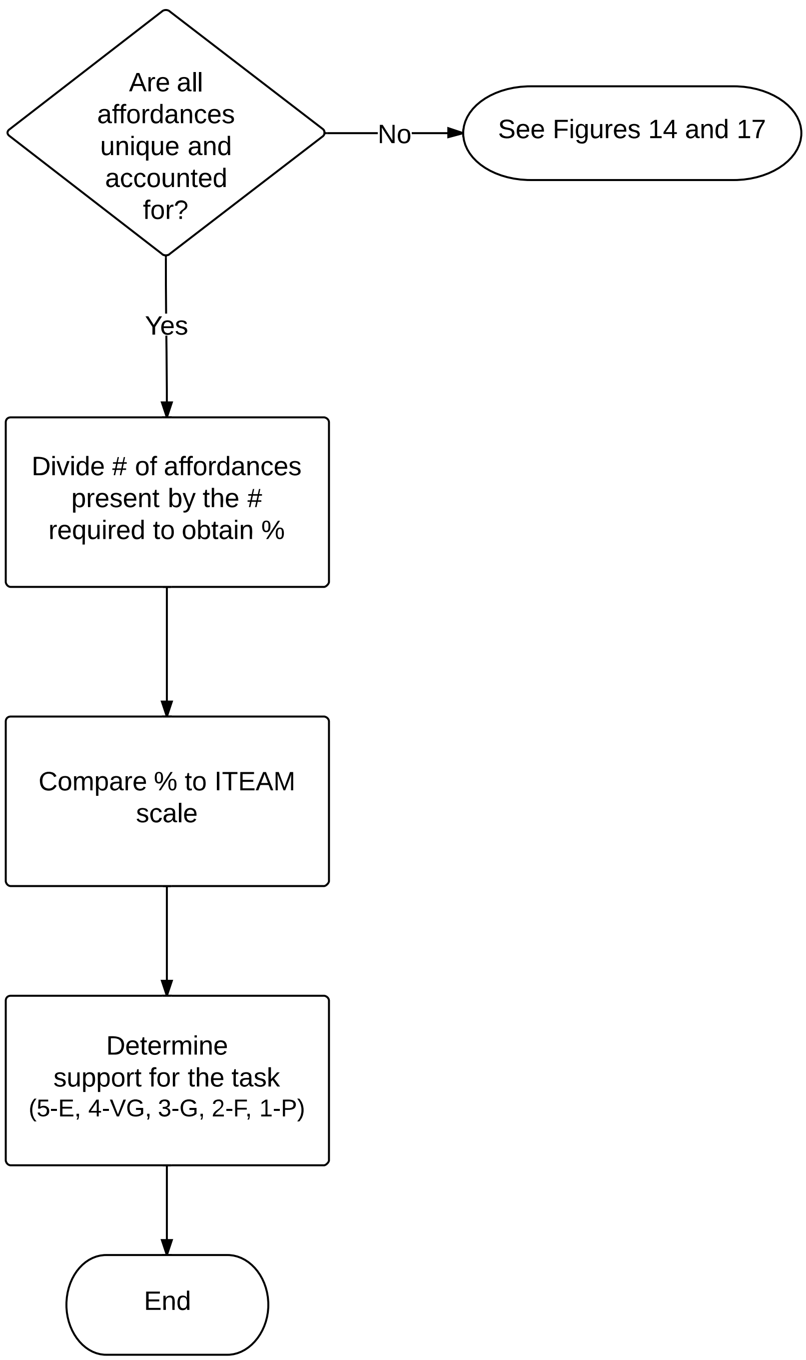

Figure 12. Process to score unique affordances

2. Subtask Affordances Previously Accounted For

If a subtask's affordances are completely accounted for in other analyses (referred to as affordance rollups), then those analyses are consulted and the ratings for their subtasks are obtained and averaged together to compile a numerical score for the current subtask under assessment. For example, if a subtask affordance requirement says see "perform terrain analysis" (Figure 13) then the evaluator goes to the evaluation for "perform terrain analysis" and collects the ratings from each of its subtasks. If more than one rollup is listed, then this process is executed for each of those rollups. Once all of the subtask scores from the rollups are collected they are summed and then divided by the total number of subtasks involved to obtain an average score. The average score now represents a number on the rating scale of 1–5 (see Figure 10). Raw scores containing 0.50 or less are rounded down to the nearest whole number for scoring purposes. Scores containing 0.51 or greater are rounded up. The process is depicted in Figure 14.

[Partial evaluation of Conduct Mission Analysis]

Real World (RW) Preconditions: Trainee has received the mission; Trainee has Issued a warning order (WARNO)			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Conduct Terrain Analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Analyze Enemy Situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Develop Commander Critical Information Requirements (CCIR)	**COGNITIVE:** Oral Expression; Oral Comprehension; Written Comprehension; Written Expression; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity;	– Trainee must be provided with materials (i.e., intelligence materials) that provide or support the inference of CCIR. – Tools to author, refine and transmit CCIR's to trainee's unit via voice or digital means. – A way to denote and link CCIR to the operational plan.	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario may provide higher headquarters CCIR if included in the OPORD. – No ability for the trainee to develop or denote CCIR for his unit or transmit CCIR as part of the COA/OPORD for execution.	5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

[Evaluation for Perform Terrain Analysis]

RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Conduct a terrain analysis from a map and materials provided by the higher headquarters using the acronym OAKOC (Obstacles, Avenues of Approach, Key Terrain, Observation and Fields of Fire, Cover and Concealment).	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Memorization **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Paragraph 1 of OPORD that provides information from higher headquarters about the terrain and weather. – Representation of the terrain that the trainee will maneuver over (e.g. map, aerial photographs) – Intelligence information about enemy emplaced, natural or man-made obstacles known by the higher headquarters – Maneuver Combined Obstacle Overlay from higher headquarters	**COGNITIVE:** **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor allows for as much or as little detail as desired in paragraph 1 of the OPORD. – Scenario editor allows for as much or as little detail as desired with respect to intelligence information – Scenario editor allows maps and simulated photography to be provided in the scenario. – No MCOO functionality exists in the game	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor 3 of 4 present
Trainee repeats analysis as necessary to maintain a current assessment					
Post conditions: Answer provided to question: What is the terrain's effect on the operation?; Graphical Terrain Analysis Overlay (GTAO) developed; Information that will support the development of his tactical plan is available					

Figure 13. Example of analysis with rollups

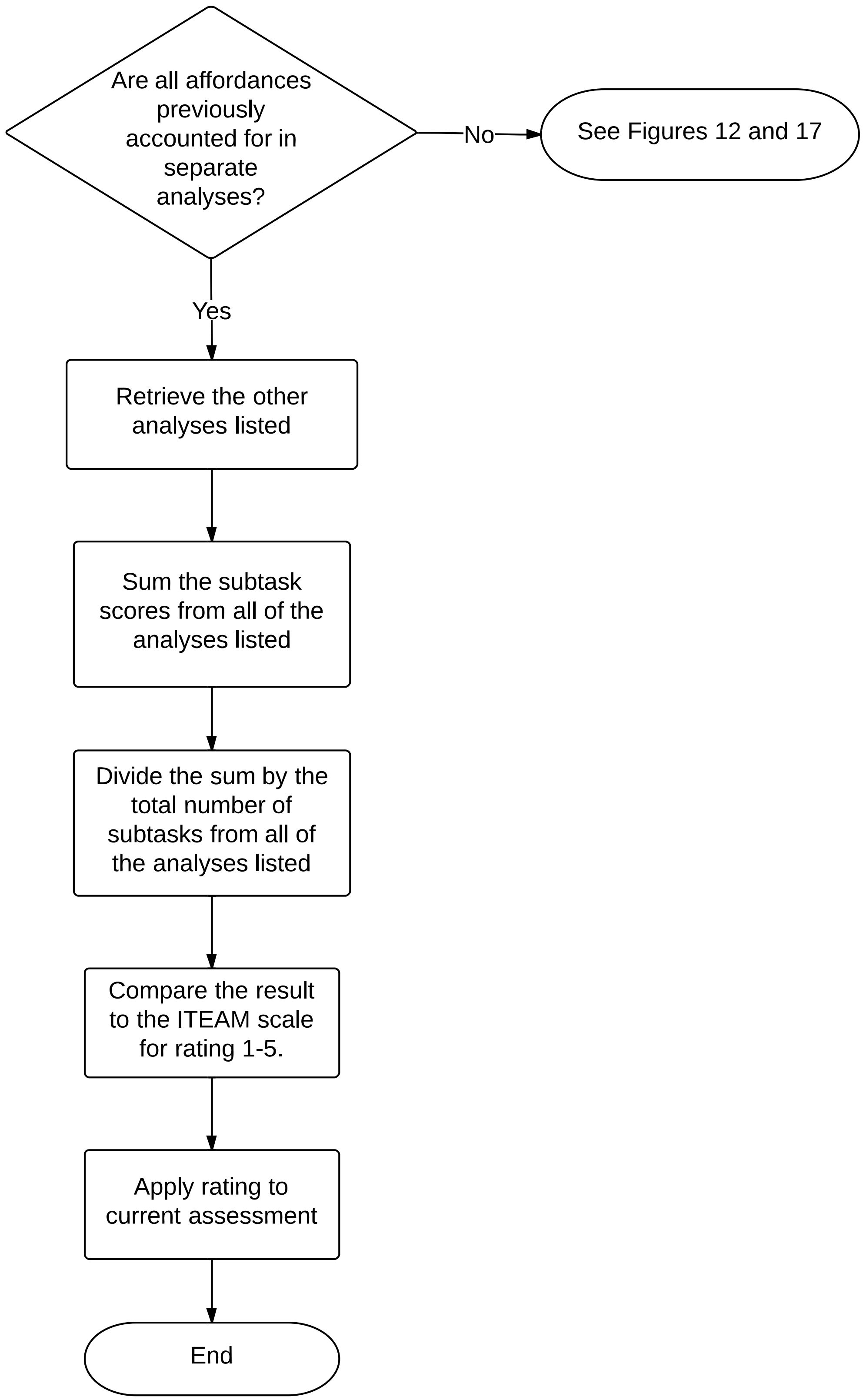

Figure 14. Process to score affordances that have been previously accounted for

3. Subtask Affordances Partially Unique

If the affordances for a subtask are partially unique and partially accounted for in other analyses (Figure 15), then the calculation is conducted in three steps. The process description that follows is depicted in Figure 17.

Real World (RW) Preconditions: Mission order provided to trainee; Fire support assets available to the trainee are specified; Trainee is knowledgeable on Urban Operations (UO) doctrine, the current ROE for use of indirect fire/mortars and the enemy situation			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Limit of Support to Training**
Process information concerning the ROE and any civil considerations affected by the use of indirect fire/mortars	**COGNITIVE:** Written Comprehension; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Memorization **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** None **PHYSICAL:** None	– ROE considerations dealing with indirect fires/mortars – See assess civil considerations	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Adjustable ROE setting and information – See assess civil considerations	5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

Figure 15. Example of a mixed evaluation (partially unique)

a. Step One

Treat each affordance rollup as an individual affordance that is present and unique. (We considered that even if a rollup score from a previous evaluation is Poor, some of the affordances are most likely present so we elected to initially treat all rollups as being present. If a case exists were none of the affordances of a rollup are present then that rollup affordance is considered absent.)

b. Step Two

Evaluate and account for the presence of any unique affordances associated with the subtask. Once every affordance is accounted for, the calculation for determining the percentage present is conducted as described in Figure 12. The result (rating of 1–5) is temporarily assigned as the subtask score. For example, a subtask contains a rollup from another analysis and one unique affordance not previously

accounted for. The absence/presence evaluation considers the rollup as present and unique and the evaluator believes that the unique affordance item is also present. This information results in the assignment of an initial score of 5 for the subtask [2 affordances required, 2 present → 2/2 = 100 percent → 5-Excellent].

c. Step Three

Obtain the values (scores) for the subtasks from the previous analyses (Figure 16) as described in "subtask affordances previously accounted for" and sum them. Add the temporary value for the subtask currently under evaluation from step two [our example from step two = 5]. Average this value by the total number of subtasks (including the current one). The derived number represents a number on the scale between 1 and 5 (see Figure 10) that when rounded appropriately (0.50 and lower round down) provides the rating for this subtask.

Real World (RW) Preconditions: Trainee is familiar with doctrinal description of assessment (FM 5-0); Trainee has knowledge and understanding about civil considerations; Trainee receives current information regarding important civil considerations in his AO.			**Environment Evaluation** No information concerning civil considerations within the AO is provided to the Trainee by the game or the scenarios violating this necessary precondition.		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Trainee develops or adopts an existing assessment mechanism to categorize civil considerations.	**COGNITIVE:** Written Expression; Oral Expression; Fluency of Ideas; Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity; Originality; Category Flexibility; Memorization **SENSORY:** Near vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Example assessment mechanism – Tools to develop an assessment mechanism (e.g., mission command systems, pens, paper, etc.) – Way to visualize assessment	**COGNITIVE:** Fluency of Ideas; Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity; Originality; Category Flexibility; Memorization **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– None	5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee gathers and processes all available information about the civil considerations in his AO.	**COGNITIVE:** Oral comprehension; Written comprehension; Inductive Reasoning; Problem Sensitivity; Information Ordering; Speed of Closure **SENSORY:** Near Vision	– Information about the civilian population, government and urban landscape. – Known friction points between civilian population and friendly forces – Known problems within the civilian	**COGNITIVE:** Written Comprehension; Inductive reasoning; Problem Sensitivity **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity;	– Scenario editor provides the ability to have as much or as little information about the population as desired. This information would come from the BN OPORD. – System does not provide any way to	5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

Figure 16. Partial evaluation for assess civil considerations

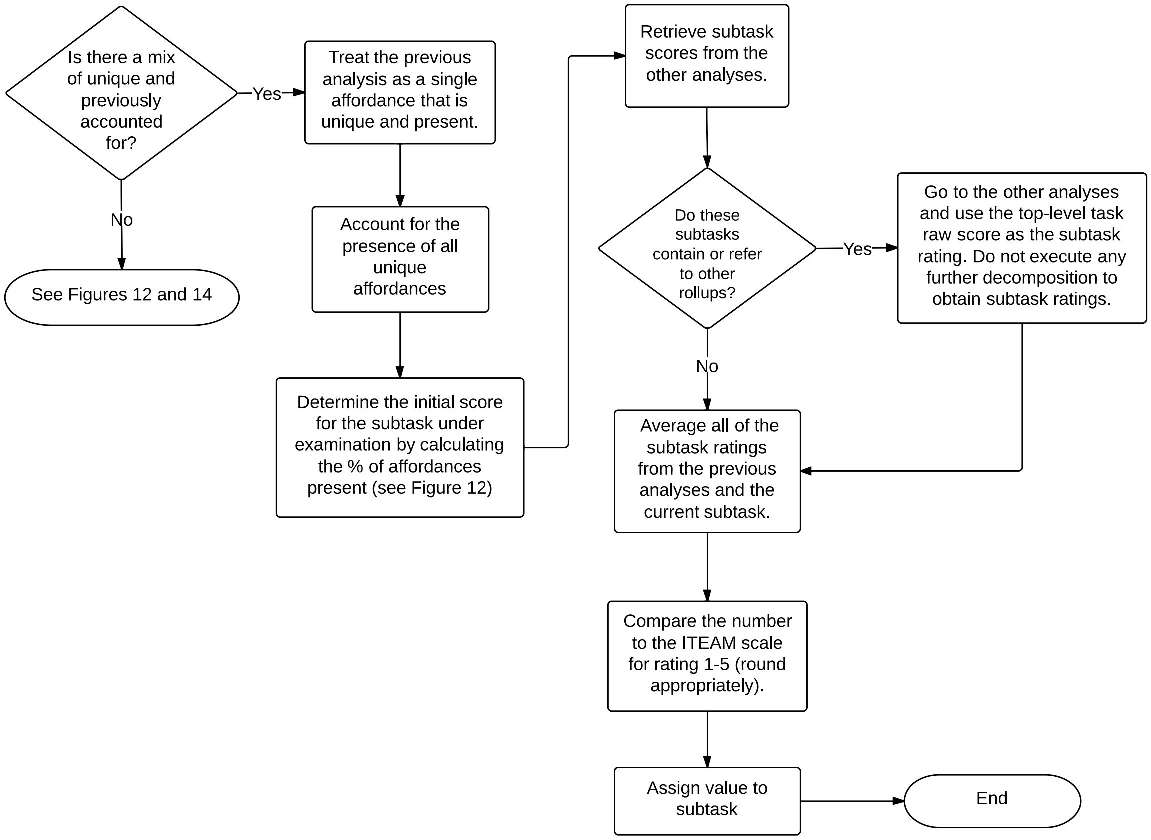

Figure 17. Process for scoring affordances that are unique and previously accounted for

4. Subtask Affordances Contained in Multiple Analyses

In the case where a task's affordances are accounted for in multiple nested layers of sub-analyses, we have elected to stop the decomposition at the top of the second nested level. Figure 18 depicts the nested analysis problem. In such a case the top-level raw score of the high-level task at the second nested level is used in the value calculation for the current subtask. The process to address this situation is shown in Figure 17 beginning at the second triangular decision node. By our estimation, conducting further decomposition during the analysis leads to inflated results.

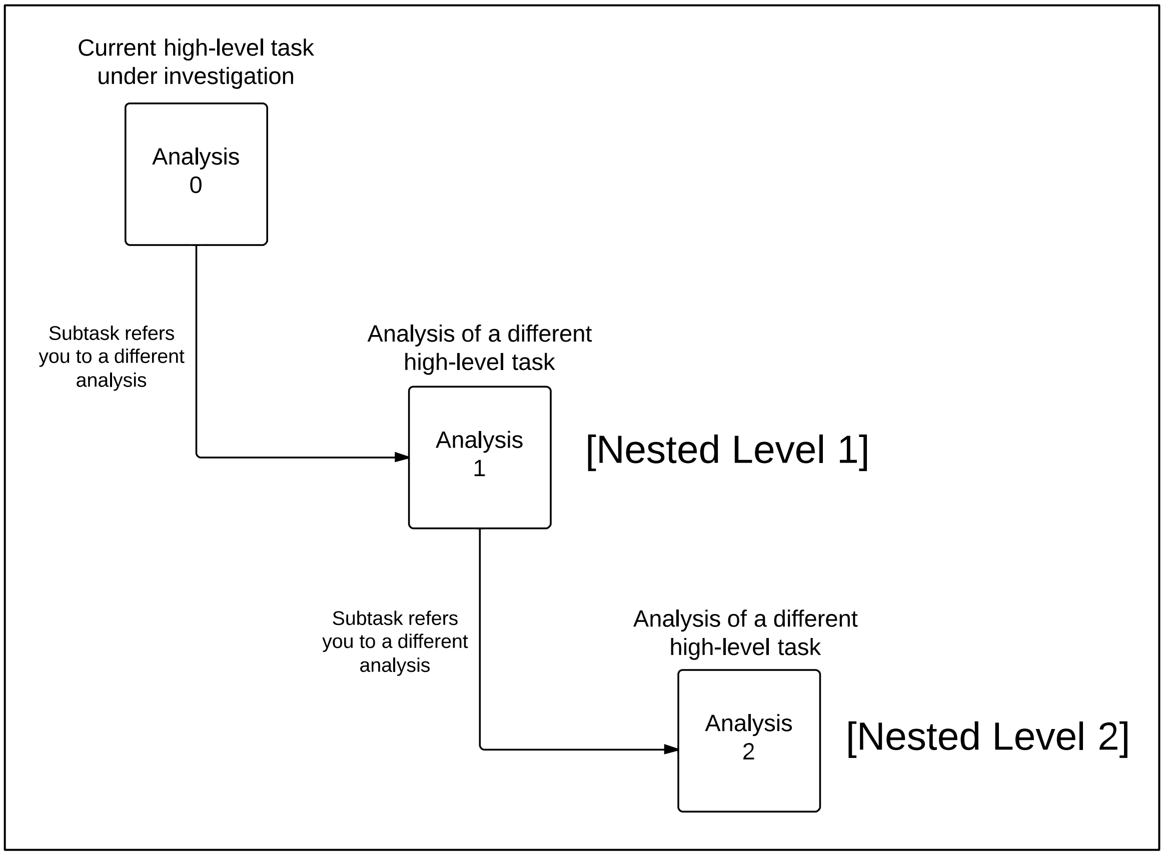

Figure 18. Depiction of nested layers of analysis

C. PROCEDURE FOR TASK SCORING

High-level tasks also are scored using the scale seen in Figure 10. The procedure to score a high-level task consists of summing all of the subtask scores and dividing them by the total number of subtasks. For example, if a high-level task has only one subtask score then that is the score for the high-level task. Another example might be a high-level task with multiple subtasks scored at 4,3,5,3,5 and 4. These subtask scores are summed (4+3+5+3+5+4 = 24) and then divided by the total number of subtasks (6) resulting in 24/6 = 4 that equates to a rating of Very Good. Scores containing a decimal of 0.50 or lower are rounded down.

D. SUMMARY

Analytical methodologies to assess simulations are not new. What is novel here is the perspective we have taken with ITEAM. ITEAM offers a systematic approach to

assess an ITE using the human rather than technology as the focal point. TA annotated with the corresponding human abilities, guides the identification of necessary affordances within the ITE. Once identified, affordances are used to determine the level of support for the practice of specific tasks. If applied as described, ITEAM provides an effective process to determine the utility of integrated training environments.

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IV. CASE STUDY I: GAME-BASED TRAINING IN AN OPERATIONAL SETTING

This study re-examined the training effectiveness analysis (TEA) study of game-based training using Virtual Battlespace 2 (VBS2): U.S. Army (USA). Version 1.23 of VBS2 was used in the original evaluation. Unfortunately, that version of the software was not available for this analysis so version 1.40, resident on the U.S. Marine Corps (USMC) Deployable Virtual Training Environment (DVTE), was used. While this version of the software was technically VBS2: USMC and newer, it contained all of the same base models and behaviors as VBS2: USA. Personnel working in the TRADOC capability manager for gaming (TCM-Gaming) office confirmed this fact. To avoid any confusion in the discussion below, the general acronym VBS2 is used.

A. METHOD

1. Brief Description of Empirical TEA Study

In 2009, TCM-Gaming in conjunction with the Army Research Institute (ARI) and Aptima Inc., conducted research designed to empirically shed light on the issue of game-based training effectiveness (Ratwani, Orvis, & Knerr, 2010). The study employed observational methods to several small unit events at the USA installations of Fort Hood Texas and Fort Lewis Washington to collect data in support of six hypotheses. The purpose of the TEA was to study the overall effectiveness of VBS2 and the impact of situational variables on training outcomes. Situational variables were used to build metrics that supported measuring skill acquisition during training. The measures applied as part of the evaluation protocol were skill preparedness, training motivation, task performance, unit process, unit cohesion, unit efficacy, and unit effectiveness. Surveys designed to gather data for each of these measures were used.

2. Application of ITEAM to VBS2 Based ITE

During this study, the full range of ITEAM processes and sub-processes were employed as depicted in Figure 6. The introduction of the game-based training effectiveness TEA stated the following as the USA's need. "The Army needs methods for

providing soldiers and leaders with effective training and opportunities to practice tasks effectively and efficiently" (Ratwani et al., 2010, p. 1). Supporting this statement of need was additional language indicating that USA personnel were already exploiting low-cost, technology-based solutions and innovative training methods in order to increase the impact and effectiveness of training. TRADOC, a significant stakeholder in the USA training and educational domain, "recognized that games have the potential to *augment and improve* [emphasis added] military training for both individuals and collectives" (Ratwani et al., 2010, p. 1). This recognition was based on the USA's use of the games DARWARS Ambush! and Tactical Iraqi for convoy and language training support. The need stated in the TEA serves as a point of departure for this analysis but provides little assistance to our efforts. According to Ratwani et al. (2010, p. 1) the USA needs "methods for providing soldiers and leaders with effective training" and "opportunities to practice tasks." The former statement is extremely vague and the later has to do with time not ITEs. The meanings of "effectively" and "efficiently" all depend on how the USA defines the terms.

The operational concept for employing game support to the deliberate practice of skills in this specific instance was a controlled classroom setting. A stated assumption of the TEA was that this training was the "crawl" part of the USA's crawl, walk, run tiered training approach. The tactical scenario on which the evaluation was based and most of the training occurred revolved around combat convoy operations. One of the base concepts for operations (CONOPS) used for the training at Fort Hood may be seen in Appendix C. Trainees utilized both desktop and laptop computers with standard keyboards, mice and headsets that allowed for their control and communication. Commercial off-the-shelf (COTS) vehicle controls were available for use by trainees designated as vehicle drivers. Synthesis of this operational concept, tactical scenario and individual feedback from Fort Hood and Fort Lewis, resulted in the general recognition that VBS2 support to the deliberate practice of tasks was mainly cognitive and sensory in nature. The functional allocation derived from the available information supported this conclusion. VBS2 provided the entire stimulus and scenario environment where soldiers would control subject avatars to execute specific activities. Classroom space at the local

mission command training center (MCTC) provided the physical environment and surroundings. The scenario development capability was part of VBS2. The unit leader and/or the civilian controller at the MCTC executed all scenario manipulations. Soldiers were represented in the game environment via avatars. Trainees accomplished avatar control through the use of the keyboard and mouse. Trainees were responsible for vehicle control using a steering wheel/pedal interface. Enemy actions were controlled by VBS2 artificial intelligence or by a MCTC employee. All equipment and vehicles necessary to conduct mission practice were provided by VBS2 within the game scenario.

The task analysis (TA) conducted in support of this effort began using the 13 items listed as skill preparedness items in the TEA. Additional tasks were listed under task performance, but those items were interpreted as the tasks necessary to use VBS2 (i.e., avatar control “buttonology”) and were not included in the TA. Each skill was used to search for relevant doctrine in the Central Army Registry (CAR). The CAR subsumed what was previously called the Reimer Digital Library (RDL). For each skill multiple doctrinal references were consulted and used to develop the TA. For those readers interested in viewing the TA, it may be found at Appendix D. The training objectives used to guide the conduct of the units training were not available for our ITEAM assessment of VBS2.

The real-world human ability (HA) inventory associated with the TA was conducted by reviewing each of the 52 HA (Fleishman & Quaintance, 1984). Those determined to be applicable were listed next to the tasks and subtasks. The rule of thumb applied to this process was to err on the side of commission versus omission. Only a small amount of iteration was applied to refine the HA list for this study due to time constraints. Affordance lists flowed from the description of the tasks as well as the human abilities associated with the tasks.

HA supported by the game, were identified by conducting an HA inventory reviewing each task/subtask with the list of 52 HA to determine which were related to game play or manipulation of the game. Example questions that guided this sub-process may be viewed at Appendix B.

The affordance inventory for VBS2 was conducted in the following manner. First a facsimile of the TEA study ITE was developed using one DVTE suite consisting of four laptop computers, headsets, mice and keyboards. The laptops were connected in a closed loop network so that four individuals could participate together as a crew. One station was equipped with a steering wheel and pedals and was designated as the driver station. Next we played the three built-in training scenarios that VBS2 provided. Following this exposure, we investigated the model library available to all users and developed several small-scale vignettes to better understand the capabilities of the scenario editor. During this process we contacted personnel at the Fort Hood MCTC and the TCM-Gaming office with questions about game capability. Finally, we enlisted the aid of one Army officer who had experience as a trainer and developer of VBS2 scenarios to help us develop and work through focused vignettes. Scoring of affordances, subtasks and high-level tasks was conducted as described in the previous chapter. Results of the assessment may be seen in Appendix D.

B. DISCUSSION

1. VBS2 TEA Results

Readers interested in the full results of the TEA should view (Ratwani et al., 2010). The results presented here for comparison are those items investigated to shed light on the skill preparedness of the trainees both before and after using VBS2. Subjective questionnaires were used as the data collection method for the original TEA. The questionnaires asked subjects to rate their preparedness both prior to and post training with VBS2. Table 1 depicts the post-training results of the seven items reinvestigated as part of this case study. 141 participants in two locations were asked their opinions of their preparedness to conduct the activities listed after conducting convoy training in VBS2. TEA scoring used an ordinal scale ranging from 1–5 with 1 = Unprepared; 2 = Slightly Prepared; 3 = Neither Unprepared nor Prepared; 4 = Slightly Prepared; and 5 = Prepared. The scores were averaged and the mean results are provided below by task in order based on preparedness level ranked from highest to lowest.

Table 1. Skill preparedness results of VBS2 TEA

Skill Preparedness Item	Mean Score
Scan my sector of responsibility	4.35
Comply with rules of engagement	4.29
Communicate with members of your unit	4.13
React to IED	4.04
Coordinate activities with your chain of command	3.90
React to an attack	3.85
Conduct CASEVAC/Recovery Operations	3.75
Scale **5**–Prepared **4**–Slightly Prepared **3**–Neither Unprepared nor Prepared **2**–Slightly Prepared **1**–Unprepared	

2. ITEAM Results

Table 2 depicts the results of the ITEAM assessment of VBS2 1.40. During the assessment, only seven items were reevaluated due to a time constraint on the study. One of the seven (Conduct CASEVAC/Recovery Operations) was broken into two tasks to simplify the analysis and then remerged for purposes of comparison. The full analysis may be viewed at Appendix D.

At the outset of the evaluation we recognized that the myriad of physical tasks associated with the skills under investigation could not be supported using VBS2. Our evaluation discovered that VBS2 contains many if not all of the affordances we listed as necessary for the deliberate practice of the skills. This result led to one interesting question and one interesting finding.

Since VBS2 was initially designed as a first-person shooter game where players control an avatar that conducts actions directed by the player, is it possible that a soldier can be trained in an activity if he controls his avatar? Discussion of this question with other researchers, soldiers and civilians who support the development of ITEs has

reached similar conclusions. No, it is not acceptable to assume that soldiers are trained simply because they control their avatar properly through a process or action.

Table 2. Results of ITEAM assessment of VBS2

Skill Preparedness Item	ITEAM Score
Scan my sector of responsibility	5.00
Comply with rules of engagement	5.00
Communicate with members of your unit	3.66 (VG)
React to IED	5.00
Coordinate activities with your chain of command	5.00
React to an attack	5.00
Conduct CASEVAC/Recovery Operations	3.42 (G)

Scale

5–Excellent: ITE contains all but a few (90–100%) of the affordances determined necessary
4–Very Good: ITE contains a significant portion (70–89%) of the affordances determined necessary
3–Good: ITE contains a good portion (50–69%) of the affordances determined necessary
2–Fair: ITE contains some (25–49%) of the affordances determined necessary
1–Poor: ITE contains very few (0–24%) of the affordances determined necessary

We believe that this highlights an intuitive finding that game ITEs are better suited to support the practice of cognitively dominant tasks. In VBS2 it is possible to extract a wounded soldier from a damaged vehicle, drag him to a non-standard medical vehicle where he can be evacuated. VBS2 goes so far as to automatically place the casualty in the evacuation vehicle. Practice of the cognitive tasks of assessing the situation and taking the appropriate actions are definitely supported. However, the physical tasks of lifting and dragging the casualty, opening doors, and walking are not supported even though the trainee controls the avatar that does those physical actions.

The finding involved bias and its effect on assessment. Our bias against a game's ability to usefully support the deliberate practice of tasks involving physical skills almost derailed our ability to objectively assess the capabilities of VBS2. This dilemma occurred even though we were following a logical process to conduct our assessment. If evaluator bias is capable of derailing assessment when a logically unbiased process is used, what

can we expect if and when *no* logical process is used? This situation strengthens our belief that a methodical process must be enforced and used during ITE assessment.

C. CONCLUSIONS

Table 3 provides a comparative view of the results from the game-based training effectiveness TEA and the ITEAM analysis. Attempting to determine the utility of VBS2 to support specific task/skill training from this TEA is dangerous considering the source of the data used to statistically support the conclusions. Using subjective trainee surveys that rely on a unit's training program as the basis to build conclusions on the effectiveness of game-based ITEs is wrong. Contributing factors to unit readiness such as leadership involvement in the training program, unit cohesiveness, efficacy, effectiveness, motivation, and preparedness for training all reflect on a holistic unit training program, but not the ITE.

The ITEAM assessment used a foundation of Army doctrine, procedures and derived tasks that facilitated a systematic review of the VBS2 ITE. The focus of the assessment was on the ITE itself and it's ability to support the deliberate practice of the tasks associated with seven skill preparedness items. The comparison of results between ITEAM and the TEA are coarse, but promising. While we draw no definitive conclusions from this case study, we are encouraged that we might be on the right track. When viewing the evaluations side by side it can be seen that ITEAM agreed with the original TEA that support for "communication with members of your unit" was at the level of a 4 (somewhat prepared [TEA], very good [ITEAM]). Additionally, soldier assessments and ITEAM both agreed that the environment least supported the deliberate practice of conducting CASEVAC and recovery operations.

Table 3. Comparison of TEA results and ITEAM assessment

Skill Preparedness Item	TEA Score	ITEAM Score
Scan my sector of responsibility	4.35	5.00
Comply with rules of engagement	4.29	5.00
Communicate with members of your unit	4.13	3.66
React to IED	4.04	5.00
Coordinate activities with your chain of command	3.90	5.00
React to an attack	3.85	5.00
Conduct CASEVAC/Recovery Operations	3.75	3.42

The TEA used in this case study represents a good example of the USA's misunderstanding and misuse of the words *training*, *skill*, and *task* and adds yet another piece of rigorous anecdotal support to the notion that games are useful. The soldiers who participated in the original study received the knowledge of how to employ the skills (collection of particular abilities) necessary to execute the tactical tasks (pieces of work) prior to the exercise event as part of a training program. This knowledge was not provided to them by VBS2. Furthermore, VBS2 represents a good example of a game that 'trains' users how to use it (i.e., the game). Training in this context describes the process where information is imparted through the use of visual and aural means that is then practiced. VBS2 training consists of three scenarios designed to allow users to practice controlling game play using the keyboard, mouse and menu options. VBS2 does provide a tool that may be used to practice specific skills linked to specific training objectives (desired outcomes). Assumed intentionally vague, the conclusion that VBS2 *positively impacts* the training outcome of skill preparedness is indisputable, but meaningless. We need to dig deeper.

V. CASE STUDY II: FULL SPECTRUM COMMAND

This chapter describes the reanalysis of the game Full Spectrum Command (FSC) to determine its utility to support the execution of 22 action items (high-level tasks). One person conducted this study over a period of four months.

A. METHOD

FSC was developed in 2004. Access to stakeholder discussions, front-end analysis and requirements documentation proved elusive. However, the redacted FSC training effectiveness evaluation (TEE) provided information for ITEAMs requirements definition process. From the TEE, the infantry captain's career course (ICCC) and infantry school stated a desire for

- A capability that would allow their students to conduct mission analysis and planning
- Experience decision-making requirements that occur during mission execution
- Enhance their ability to adapt to emerging threats and changing conditions on a simulated battlefield and
- Repeated opportunities to practice and actually experience the consequences of executing or changing their operational plans in response to emerging conditions on the battlefield (Beal & Christ, 2004).

Specific needs or measurable performance shortfalls were not identified in the TEE, so we focused our attention on the intent of the ICCC to provide trainees with experience in developing plans and reacting to changes in their plans during contact. We did not assume what improved performance looked like, rather we inferred the intent for the ITE was to support deliberate practice and that performance improvement would be judged using some other instrument within the ICCC program of instruction (POI).

Next we turned our attention toward how the stakeholders envisioned FSC supporting the ICCC and any information that revealed what functions were specified for the game. Subject matter experts (SMEs) who worked at the infantry school and were involved with the development and evaluation of FSC provided feedback that indicated FSC was not initially intended for use within the ICCC POI. They were unaware of any

discussions of system functionality or intent of system implementation within the ICCC POI. Stakeholder expectations of system users were absent from the FSC TEE. We inferred general system and trainee functional allocations based on statements referring to adaptive decision-making and deliberate practice. The TEE did mention the following characteristics of FSC, which provide limited insight into some of the desired system functionality.

- FSC permits players to respond to emerging battlefield conditions.
- FSC permits players to practice behaviors necessary to acquire and maintain adaptive decision-making skills in a realistic and dynamic tactical environment.
- FSC has the capability to replay specified portions of mission execution facilitating performance feedback.

It remains unclear what specific behaviors are necessary to "acquire and maintain adaptive decision-making skills" (Beal & Christ, 2004, p. 2).

The original TEE did not contain or allude to any job or TA that was conducted in support of the development of FSC. In order to initialize this critical stage of analysis, we decided to use the ICCC action items listed as part of the survey instrument given to the trainees. The action items provided the best starting point for the development of a TA to help describe the training that FSC needed to support. Initially, all action items were reviewed and the doctrine that governed their description consulted. Since FSC was intended for use at the company commander level, we reviewed doctrine from the Army level down to the company level (i.e., FMs 3-0, 3-21.8, 3-21.10 and 5-0), including any specific doctrine for a warfighting function covered by FSC (e.g., breaching and engineers). This review of doctrine ensured that we had a good understanding of how infantry officers and their attached assets operate together in tactical, operational and strategic environments. During the review it was discovered that many of the appropriate manuals had been updated since FSC was originally evaluated. The refresh of the doctrine did not adversely affect our assessment because no changes were made to the USA troop leading procedures or the military decision making process.

Figure 18 depicts an organized hierarchy of the action items based on USA doctrine. We recognized early that many of the action items listed for evaluation were

sub or sub-sub processes of a larger military analysis procedure and that the ICCC was not necessarily interested in using FSC to support the entire process. Placing the items into the hierarchy seen in Figure 19 provided context for the conduct of the TA. Organizing the action items in this fashion assisted us with identifying the pieces we needed to assess.

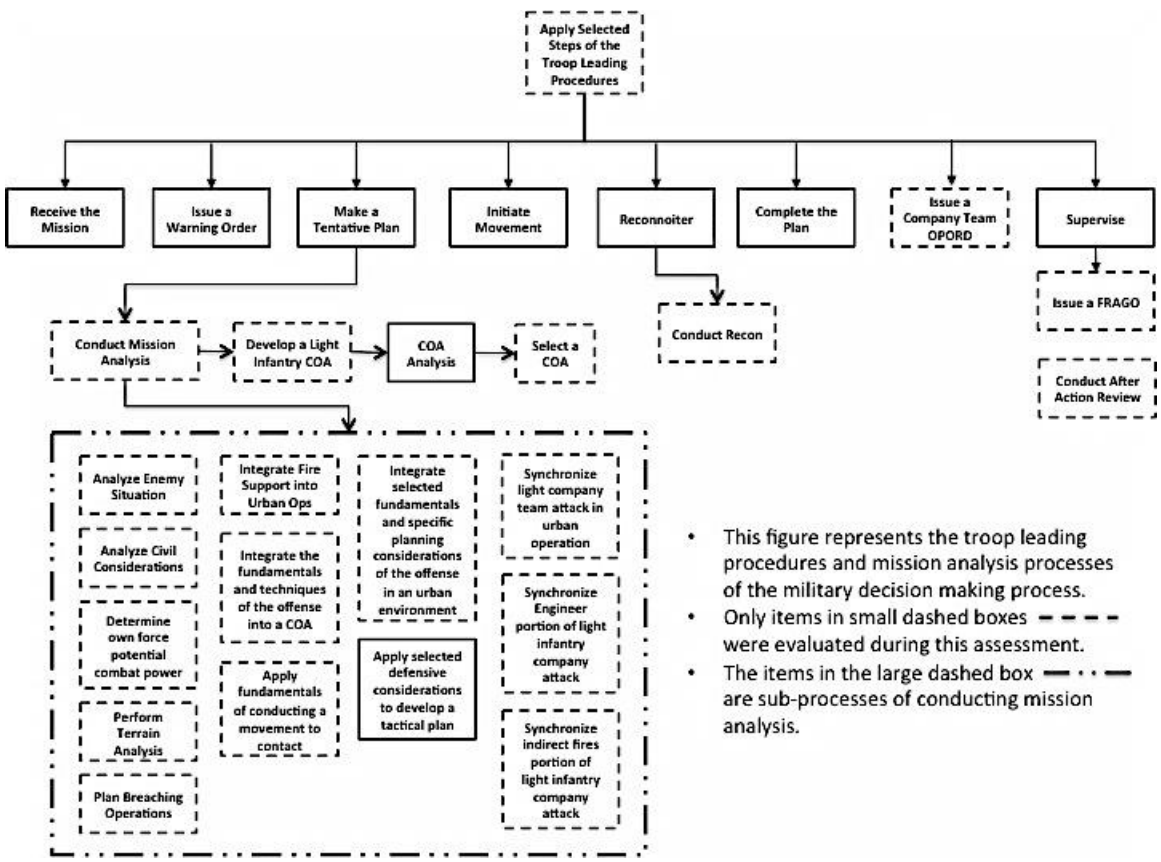

Figure 19. Action items in the context of the military decision making process

The format used for the TA is one commonly found in graphical user interface (GUI) design (Gieskens & Foley, 1991; Vonguru, 1995). The format consists of listing preconditions for the desired actions and then the critical tasks followed by any post-conditions resulting from the actions taken. The precondition/task/post-condition format is nicely suited to evaluating tasks supporting military training systems. Several iterations of review were executed to refine the TA. The TA reflects our experience in the military

domain and was reviewed by several infantry officers to gain consensus with the level of detail provided. Readers wishing to see more information about the TA are referred to Appendix E.

Details harvested from the FSC TEE included one terminal-learning objective:

> The ICCC course terminal learning objective for this week is for the student to demonstrate an improvement of his visualization of the tactical problem and an ability to describe his plan for executing and synchronizing a light company course of action in urban operations. (Beal & Christ, 2004, p. 3)

As part of their public information campaign to promote FSC, the Institute for Creative Technologies (ICT) stated that the military decision-making process (MDMP), course of action (COA) development and COA adaptation were also learning objectives for the game. The ITEAM assessment of FSC indicates that these objectives are supported to a certain extent, but without measures of effectiveness and performance, determining success on these learning objectives is impossible.

The human ability requirements (HA) associated with the various tasks reflect the kinds of things that are required of the human when executing the task elements. Each task item was screened against all 52 HA to determine which ones were required to accomplish the task. HA were listed by category (i.e., cognitive, sensory, psychomotor or physical). The designation of the abilities by category greatly assisted in identifying the kind of training FSC was best suited for (i.e., cognitive decision making versus physical reconnaissance). Several reviews of the abilities and their definitions resulted in a fairly consistent application across each action item.

Affordance requirements were derived from the description of the tasks and the HA associated with them. Initially, affordances were described in a purposefully vague manner (e.g., a way to draft a plan). Review by military SMEs and discussion with other researchers, resulted in the addition of detail to the affordance requirements. Affordance requirement descriptions evolved over several iterations of review and were not easily constructed. Many of the same affordances showed up in several different places throughout the analysis.

The HA supported by the ITE were discovered by answering questions like "how do soldiers do this in the game and what HA are supported by the game to accomplish the task?" Interestingly, little difference was identified regarding real world and system supported HA for most of the cognitive activities. Noticeable differences were seen in the application of physical abilities.

Determining FSC affordance resources in the ITE was done through multiple iterations of document and game review. We first conducted a thorough review of the redacted FSC TEE and user manual followed by game play. The review of the user's manual and scenario editor highlighted many capabilities that resulted in the high positive feedback by the ITEAM methodology. The game was evaluated by playing each scenario and by careful investigation of the scenario editor. After this activity, each action item was revisited and annotated with the affordances that we identified as being present.

Table 4 depicts the results of analysis from each individual action item in the FSC report and subsequently by ITEAM. Interested readers will find the individual analyses for each action item located in Appendix E. Mean scores were chosen for comparison between the two forms of evaluation so that the two methods of assessment could be evaluated fairly. The FSC TEE mean rating scores listed in Table 4 were compiled from survey opinion data provided by a group of USA ICCC students asked to rate FSC's ability to support the 22 action items listed. Student scoring was conducted using a four-point scale of 1 = Not at all; 2 = Not very well; 3 = Moderately well; and 4 = Very well. ITEAM scoring used a five-point scale (Figure 10) where 1 = Poor; 2 = Fair; 3 = Good; 4 = Very Good and a 5 = Excellent. The FSC TEE did not assign overall ratings for the games ability to support training the action items (column "support level"). We have provided the overall ratings here to enable comparison. One assumption made during this comparison is that the rounding of scores 0.50 and below was downward which is the same way we handled scores containing 0.50 or below in ITEAM.

Table 4. Summary of original five-point ITEAM and four-point FSC report evaluations

Action Item	FSC report support level	FSC Mean	ITEAM Assessed Level	ITEAM Mean Rating	FSC/ITEAM Agreement Y/N
Analyze civil considerations	Not very well	2	Fair	2.0	Yes
Analyze the enemy situation	Moderately well	3.2	Very Good	3.67	No
Apply selected defensive considerations to develop a tactical plan	Not very well	2.4	**Not Evaluated**	**Not Evaluated**	**NA**
Apply selected steps of the troop leading procedures	Moderately well	3	Good	3.25	Yes
Apply the fundamentals of conducting a movement to contact (MTC)	Moderately well	2.7	Very Good	4	No
Conduct an after action review for a light infantry company	Moderately well	3	Good	3	Yes
Conduct mission analysis	Moderately well	3	Good	3.36	Yes
Conduct reconnaissance	Moderately well	2.8	Good	2.66	Yes
Develop a course of action for a light infantry company team	Moderately well	3.5	Good	3.5	Yes
Determine own force potential combat power	Moderately well	3.3	Excellent	5	No
Integrate fire support into urban operations	Moderately well	2.8	Very Good	4	No
Integrate selected fundamentals and specific planning considerations of the offense in an urban environment	Moderately well	2.9	**Not Evaluated**	**Not Evaluated**	**NA**
Integrate the fundamentals and techniques of the offense into a course of action	Moderately well	3.0	Good	3.28	Yes
Issue a company/team OPORD	Not very well	2.2	Good	3	No
Issue a FRAGO	Moderately well	3.2	Very Good	4	No
Issue OPORD for infantry company (redundant)	Not very well	2.2	**Not Evaluated**	**Not Evaluated**	**Na**
Perform terrain analysis	Moderately well	2.6	Very Good	4	No
Plan breaching operations	Moderately well	3.0	Very Good	4	No
Select a course of action (COA)	Moderately well	3.3	Good	3	Yes
Synchronize a light company team attack in an urban operation	Moderately well	2.9	Good	3.35	Yes
Synchronize the engineer portion of a light infantry company attack	Moderately well	2.6	Good	3.37	Yes
Synchronize the indirect fires portion of a light infantry company attack	Moderately well	2.9	Good	3.35	Yes

Students scored the game based on their interaction with it during hands-on play, observational play, demonstration and training on how to use the game. The FSC TEE reflected the student exposure time as shown in Table 5. Based on Table 5, we inferred that, on average, students based their assessment of FSC's ability to support training on 7.8 hours of various types of exposure to the game. This exposure time was not continuous but occurred over a period of one week. As mentioned previously, we conducted the ITEAM assessment of FSC over a period of four months with the majority of that time being spent on data mining the literature and doctrine as well as playing the game.

Table 5. Mean (SD) time of exposure to FSC in minutes (from Beal & Christ, 2004)

Demonstration and Train-up (min)	Hands-on FSC Play (min)	Observational FSC Play (min)
288 (73)	120 (95)	168 (81)

B. DISCUSSION

After conducting a thorough investigation of the capabilities of FSC, we generated the results available in Table 4 and reflected graphically in Figure 20. Comparison of results between the TEE and ITEAM showed that ITEAM consistently rated FSC capability higher than the TEE. We speculated that one possible explanation for ITEAMs consistently high scores might have to do with the differences in scale between the TEE and ITEAM.

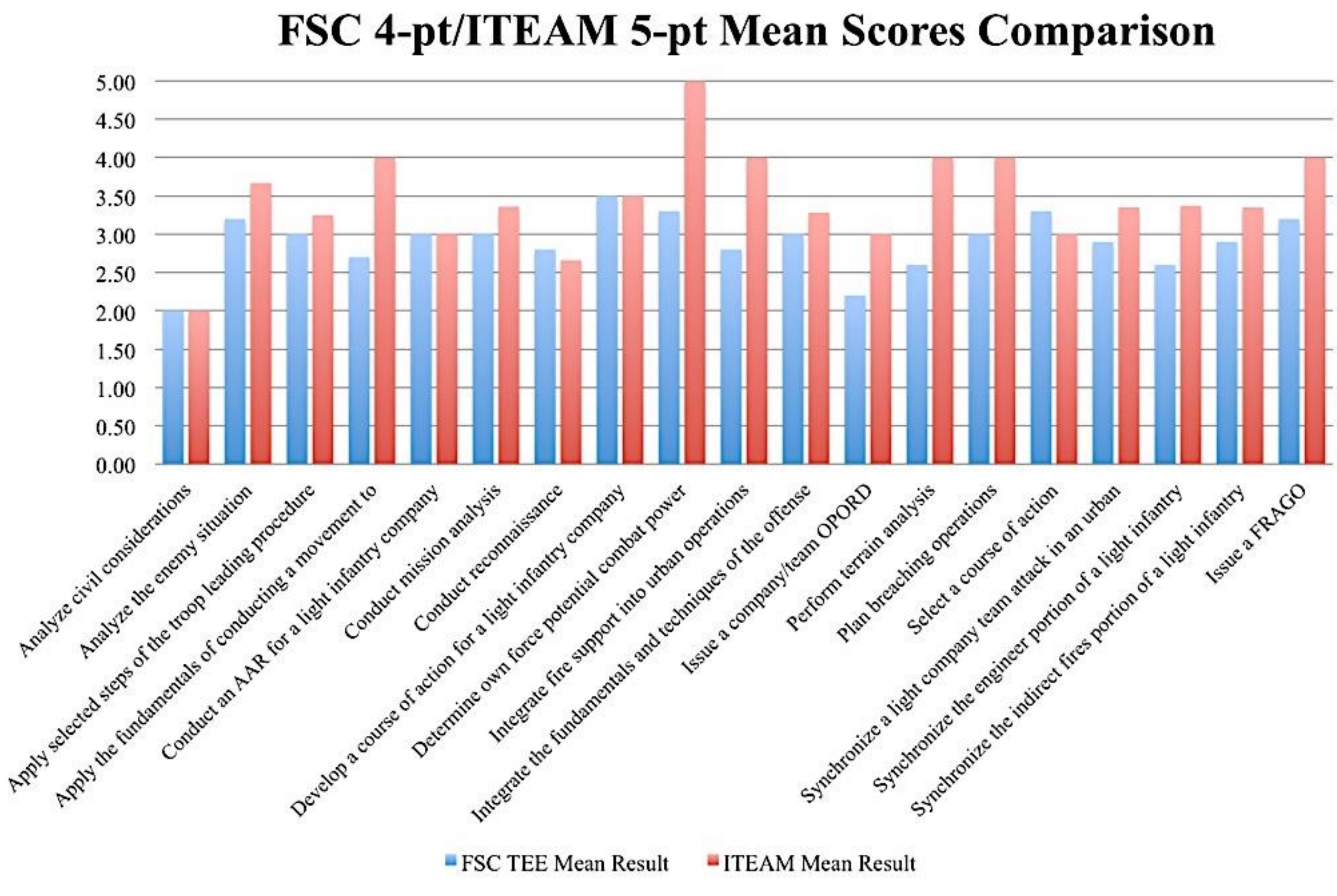

Figure 20. Comparison of initial mean scores between ITEAM and FSC

In an attempt to adjust for the differences in scoring, the ITEAM scale was adjusted from a five–point scale to the four–point-scale shown in Figure 21. Scoring of affordances and overall rating of action items was re-conducted similarly to the original analysis only now using the four-point scale. The revised individual analysis results are available in Appendix F and may be viewed graphically in Figure 22. As expected, this change enabled better alignment between the ITEAM and TEE results.

Scale Definition

4–Very Good – the ITE contains a significant portion (75–100%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–74%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Figure 21. Revised four-point scale definition for ITEAM/FSC comparison.

One final adjustment to the data analysis allowed us to reach our final comparison values. Since neither the FSC TEE nor ITEAM scales contain decimal values we rounded all of the scores so that they would match the rating scales. This adjustment provides us with the graphical view of the data seen in Figure 23. Figure 23 demonstrates that in a comparison using equivalent scales, we were able to predict 13 of the 19 ratings given to FSC by a group of 24–26 infantry officers. Based on the number of evaluations attempted (19), this results in a success rating of 68 percent. Table 6 provides the four-point scale data results side by side for comparison.

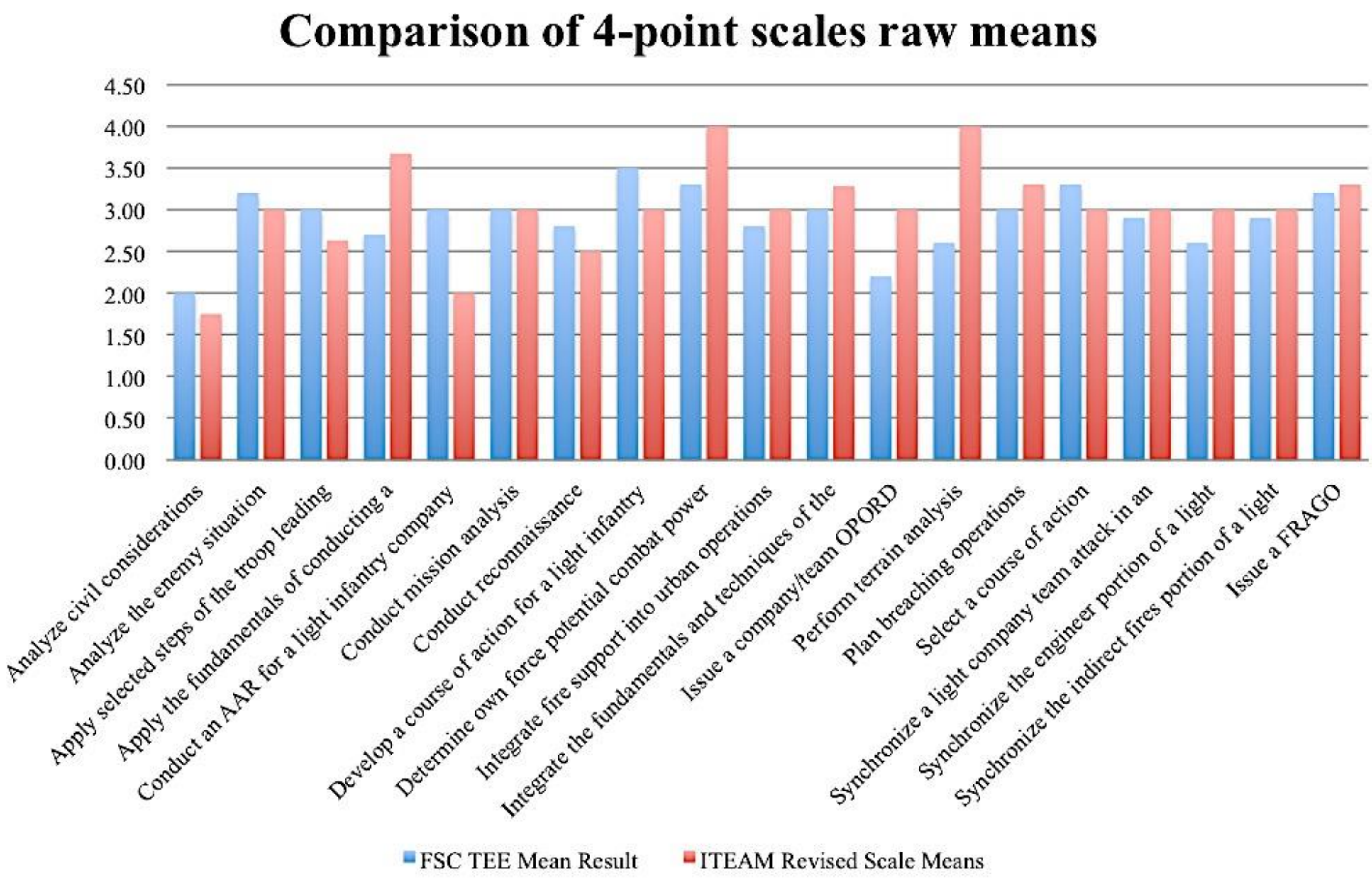

Figure 22. FSC four-point/ITEAM four-point raw mean comparison.

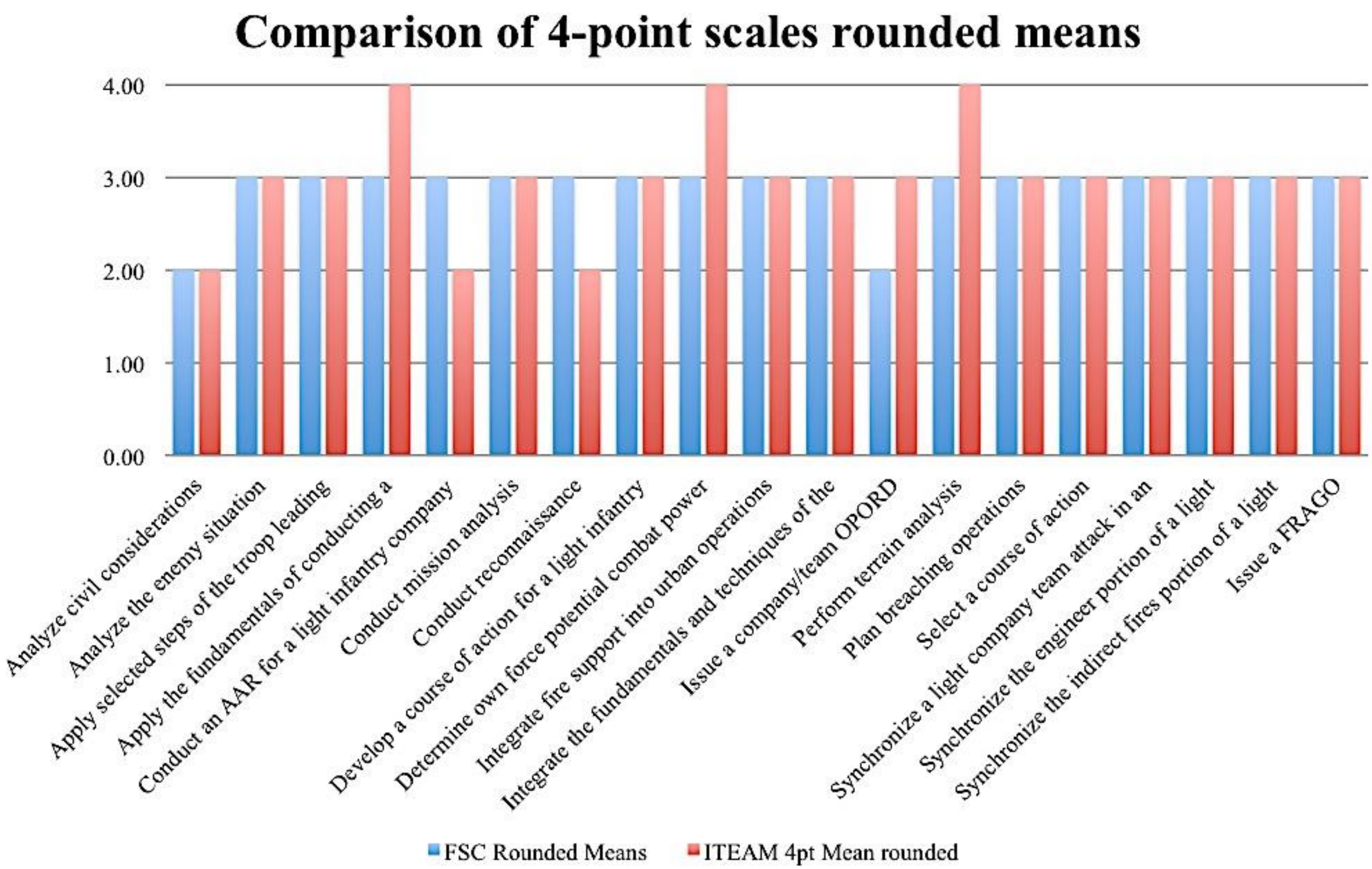

Figure 23. FSC four-point/ITEAM four-point rounded mean comparison

Table 6. Final summary of ITEAM and FSC report evaluations of FSC action items.

Action Item	**FSC TEE support level**	**FSC Rounded Mean**	**ITEAM Assessed Level**	**ITEAM Scaled Rounded Mean**	**ITEAM Agreement with FSC TEE Y/N**
Analyze civil considerations	Not very well	2	Fair	2	Yes
Analyze the enemy situation	Moderately well	3	Good	3	Yes
Apply selected defensive considerations to develop a tactical plan	Not very well	2	**Not Evaluated**	**Not Evaluated**	NA
Apply selected steps of the troop leading procedures	Moderately well	3	Good	3	Yes
Apply the fundamentals of conducting a movement to contact (MTC)	Moderately well	3	Very Good	4	No
Conduct an after action review for a light infantry company	Moderately well	3	Fair	2	No
Conduct mission analysis	Moderately well	3	Good	3	Yes
Conduct reconnaissance	Moderately well	3	Fair	2	No
Develop a course of action for a light infantry company team	Moderately well	3	Good	3	Yes
Determine own force potential combat power	Moderately well	3	Very Good	4	No
Integrate fire support into urban operations	Moderately well	3	Good	3	Yes
Integrate selected fundamentals and specific planning considerations of the offense in an urban environment	Moderately well	3	**Not Evaluated**	**Not Evaluated**	NA
Integrate the fundamentals and techniques of the offense into a course of action	Moderately well	3	Good	3	Yes
Issue a company/team OPORD	Not very well	2	Good	3	No
Issue a FRAGO	Moderately well	3	Good	3	Yes
Issue OPORD for infantry company (redundant)	Not very well	2	**Not Evaluated**	**Not Evaluated**	NA
Perform terrain analysis	Moderately well	3	Very Good	4	No
Plan breaching operations	Moderately well	3	Good	3	Yes
Select a course of action (COA)	Moderately well	3	Good	3	Yes
Synchronize a light company team attack in an urban operation	Moderately well	3	Good	3	Yes
Synchronize the engineer portion of a light infantry company attack	Moderately well	3	Good	3	Yes
Synchronize the indirect fires portion of a light infantry company attack	Moderately well	3	Good	3	Yes

C. CONCLUSIONS

The original FSC TEE collected data from the participants involved in the study through the use of various survey items. An empirical test using a robust simulation was designed and executed to collect data pertaining to student performance. Considerable statistical analysis was executed on the data collected to draw conclusions. In the end, as the report states, the results were inconclusive, meaning evaluators were unable to determine the training effectiveness of FSC. Reasons stated for this were the result of unforeseen obstacles to the empirical protocol as well as the lack of any identified improvement of decision-making by the trainees. Perhaps the result was due to the lack of focus on FSC and too much focus on soldier performance. While improvement in performance is a good measurement to indicate the value of an ITE, it only works if the capabilities of the system are known beforehand and applied appropriately.

As we investigated FSC and applied our analytical methodology, several things came to light about the original TEE. First, FSC was never the main focus of the ARI study; rather it was an enabler to the larger investigation into adaptive decision-making. We believe that categorizing this study as a TEE of FSC was inappropriate. Second, opinions of users who were unfamiliar with the full capability of FSC, ISD/SAT and the tasks, were relied upon to judge the utility of FSC. These same users based their opinions on scenarios that we believe were incomplete, possibly by design. So instead of providing a full picture of the capabilities of FSC and requesting feedback, users were only exposed to some of the capability of FSC and then offered their opinions. The attempt to statistically infer the value of FSC based on decision-making style and personal information did not lead to an accurate picture of FSC's utility or potential.

During our initial review of FSC, we felt that the game was not suitable for military training at all (evaluator bias). However, after we conducted our analysis using ITEAM, that opinion was drastically changed. Merely passing judgment based on opinions is not as effective or reliable as basing opinions on structured analysis. Users were never asked whether FSC supported the accomplishment of any specific tasks. They were asked whether they felt that the game allowed them to conduct certain action items.

If asked to decompose those actions and then consider the human abilities needed to conduct them, we believe that students would have adjusted their assessments.

Despite our desire for a larger number of matches to the TEE we were able to predict the level of support provided by FSC for 13 of 19 items. Four of our evaluations were higher (more positive) than those of the TEE and two were lower (more negative), which leads to the question of why are they different? We believe the answers can be found in the consistency in application of ITEAM and user opinion. Inconsistent application of a process leads to inconsistent results. During our review and scoring adjustment of ITEAM, it became apparent that in several instances we might have treated the same or similar affordances differently in parts of our evaluation. We believe that in at least one case, this action directly resulted in our rating being higher than that in the FSC TEE, which when rounded, resulted in an ITEAM result being higher than the TEE rating. The level of knowledge supporting an opinion is important. We believe that a more powerful reason for the difference in ratings is the result of FSC users not being fully aware of the capabilities of the game during their evaluation and basing many of their ratings on the limited game scenarios they interacted with.

VI. CASE STUDY III: EST 2000 HEAVY WEAPONS TRAINER

A. METHOD

ITEAM was used in this study to reexamine the Engagement Skills Trainer (EST) 2000. The TRADOC Analysis Center (TRAC), White Sands Missile Range (WSMR) conducted a training effectiveness analysis (TEA) of EST 2000 heavy weapons training in March of 2008. The focus of the TEA was to determine if the use of the EST could mitigate the impact of ammunition shortages for the M2 .50 caliber Browning machine gun and the MK19 modification 3, 40 millimeter (mm) grenade machine gun on soldier proficiency (Hughes & Nau, 2008). The EST 2000 is described as a laser-based unit/institutional, indoor, multi-purpose arms trainer that displays targets, terrain and weapon effects in a real-time, three dimensional presentation on a screen that is 26 feet 3 inches from the firer (Hughes & Nau, 2008). The system has 11 different types of weapons that may be used for engagement practice ranging from the M9 Berretta pistol to the MK19 grenade machine gun. Qualification and crew engagement practice are both possible with the EST 2000.

The impetus for the original 2008 study was an ammunition shortage at the training bases responsible for conducting initial military training for soldiers. It was presumed that the ammunition shortages, caused by engagements in both Iraq and Afghanistan, would continue to exist and that alternative approaches to training heavy weapons were required. Therefore, the TRADOC commander requested that a study be conducted to determine if substituting virtual simulation practice for live fire practice would impact soldier proficiency on the M2 and MK19 and to what extent. Two objectives and two essential elements of analysis (EEA) were listed in the 2008 TEA for the EST.

- Objective 1. Determine the effect of substituting EST 2000 training for M2 .50 caliber live-fire training.
- Objective 2. Determine the effect of substituting EST 2000 training for MK19 40mm live-fire training.

- EEA 1. How does the quality of EST 2000 training differ from live-fire training in terms of impact on end-of course weapons' proficiency with the M2 .50 caliber and MK 19 40mm grenade machine guns?
- EEA 2. Can EST 2000 training effectively substitute for live-fire training in terms of its impact on target engagement proficiency with the M2 .50 caliber and MK 19 40mm grenade machine guns?

The stated scope of the TEA study was based on live-fire day qualification training of both weapons and the focus was on evaluating the quality of EST 2000 training, not on evaluating the initial-entry training (IET) heavy weapons training programs (Hughes & Nau, 2008).

Review of the objectives, stated EEAs, scope and focus of the TEA led us to believe that the study was improperly focused to determine if deliberate practice with the EST 2000 could reduce or eliminate the need to conduct deliberate practice using live ammunition. The EST 2000 does not train soldiers—rather, it is an ITE that allows for the deliberate practice of such skills as the four fundamentals of marksmanship (steady position, proper sight picture, proper breathing, and trigger squeeze), target identification, range determination, and target engagement with a selected weapon system. With this perspective, our evaluation focused on whether or not the EST 2000 ITE contained the necessary affordances to facilitate task execution and deliberate practice of the skills involved in engaging targets using both the M2 and MK19 weapon systems.

We began this study with a review of the weapons manuals for the MK19 and M2 as well as a review of the day qualification shooting standards for both weapons (i.e., DA forms 7518-R and 7448-R respectively). We recognized that in this study it was not necessary to describe the operational need or to determine and describe the ITE capabilities using an operational concept and functional allocation. Since the EST is an established ITE whose scope is clear we did not believe these two steps were necessary. Figure 24 depicts the sub-processes of ITEAM used for this study.

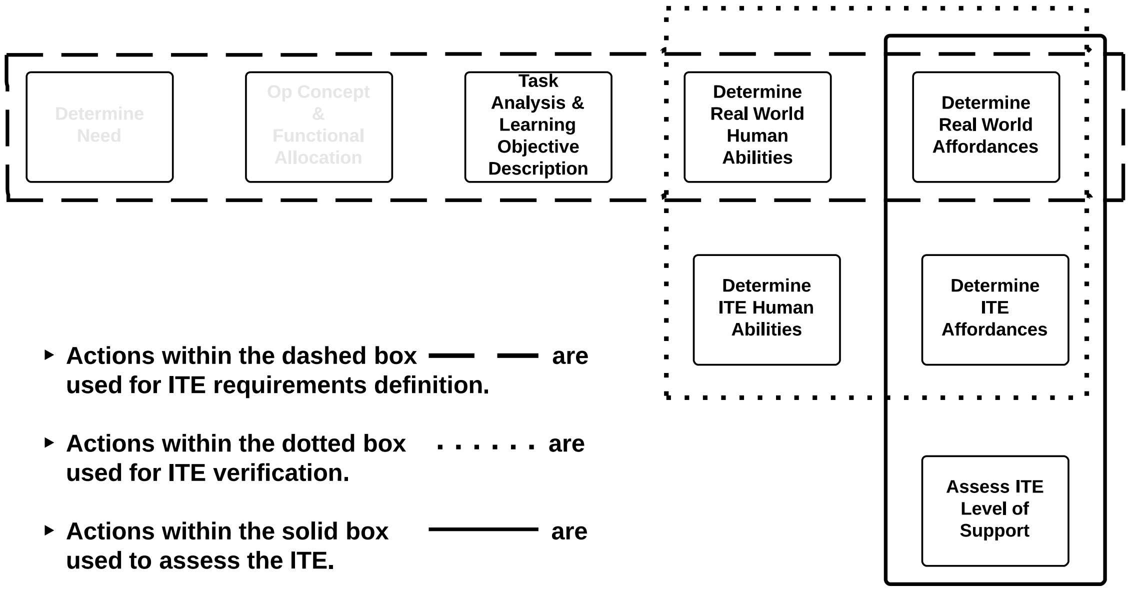

Figure 24. ITEAM steps utilized during this evaluation

This study began by conducting a task analysis (TA). We started by defining the high-level tasks and the preconditions supporting the assessment. Several of the preconditions were assumptions about the IET heavy weapons program that were not considered in the original TEA and were also beyond the scope of the present assessment. We conducted the TA for both weapon systems that included activities we felt necessary for the high-level task under investigation. The detailed results of the ITEAM assessment of the MK19 and M2 may be found in Appendix G.

B. DISCUSSION

The results of the ITEAM assessment predicting the EST 2000's ability to support the deliberate practice of engaging targets with the M2 and MK19 was a 4.00 very good and 4.43 very good respectively (Table 7). In their evaluation of the EST, TRAC-WSMR found no statistical difference in live fire qualification scores between the two groups who solely used the EST to practice target engagement and those who solely used live fire practice (Hughes & Nau, 2008). This outcome is consistent with our prediction that the ITE supports the deliberate practice and skill acquisition of target engagement very well. The results of soldier opinion surveys also support the ITEAM assessment. Soldiers

and instructors were asked to rate the quality of their prequalification training as excellent, good, adequate, inadequate, poor, and very poor. For the M2, 50 percent of respondents rated their pre-qualification EST training preparing them for live fire as good and an additional 13 percent rated it as excellent. For the MK19, 36 percent rated their EST pre-qualification training as good and 41 percent rated the training as excellent. Tables 8 and 9 depict the results of the ITEAM assessment and TEA user surveys of the EST 2000.

Table 7. ITEAM assessment score for EST 2000 HW M2 and MK19

M2	MK19
4.00 Very Good	4.43 Very Good

Scale

5—Excellent: ITE contains all but a few (90–100%) of the affordances determined necessary

4—Very Good: ITE contains a significant portion (70–89%) of the affordances determined necessary

3—Good: ITE contains a good portion (50–69%) of the affordances determined necessary

2—Fair: ITE contains some (25–49%) of the affordances determined necessary

1—Poor: ITE contains very few (0–24%) of the affordances determined necessary

Table 8. M2 firer ratings of prequalification training (number and percent responding) (from Hughes & Nau, 2008)

Rating	Group I Live Training		Group II Familiarization Fire + EST Training		Group III EST Training		Total Respondents
	Number	Percent	Number	Percent	Number	Percent	
Excellent	8	33	3	13	3	13	14
Good	5	33	12	52	12	50	29
Adequate	8	21	4	17	6	25	18
Inadequate	3	13	2	9	2	8	7
Poor	0	0	1	4	1	4	2
Very Poor	0	0	1	4	0	0	1
Total	**24**	**100**	**23**	**100**	**24**	**100**	**71**

Note: No statistically significant differences between groups (Chi-Square = .657, df = 2, p>.05) in terms of Good or Excellent ratings versus Adequate or below ratings.

Table 9. MK19 firer ratings of prequalification training (number and percent responding) (from Hughes & Nau, 2008)

Rating	Group I Live Training		Group II Familiarization Fire + EST Training		Group III EST Training		Total Respondents
	Number	Percent	Number	Percent	Number	Percent	
Excellent	11	48	4	17	9	41	24
Good	10	43	9	38	8	36	27
Adequate	2	9	7	29	4	18	13
Inadequate	0	0	2	8	0	0	2
Poor	0	0	2	8	1	5	3
Very Poor	0	0	0	0	0	0	0
Total	**23**	**100**	**24**	**100**	**22**	**100**	**69**

Note: Statistically significant difference among groups in terms of "Good" or "Excellent" ratings versus "Adequate" or below ratings (Chi-square = 7.442, df= 2, p<.01).

Tables 10 and 11 depict the qualification scores for each of the groups evaluated in the original TEA. Using ITEAM, we predicted that the EST 2000 HW M2 and MK19 would support the performance of the high-level task of target engagement very well. The results of the qualification firing assessment and the prediction made using ITEAM are consistent with our original hypothesis that *an analytical assessment methodology based on human abilities and affordance theory can predict task elements within an integrated training environment with the highest likelihood of positive training transfer*.

Table 10. M2 Qualification Average Hits (Out of Possible 11 at Fort Sill and 9 at Fort Benning (from Hughes & Nau, 2008)

Location	Qualification Rounds Per Firer	Group I Live Training		Group II Familiarization Fire + EST Training		Group III ST Training		Total Firers
		Number	Hits	Number	Hits	Number	Hits	
Fort Sill	182	3	4.67	3	7.00	3	8.33	9
Fort Sill*	114	9	4.56	8	4.63	9	3.44	26
Fort Benning	140	12	6.83	12	7.33	12	7.08	36
Total		**24**	**5.71**	**23**	**6.35**	**24**	**5.88**	**71**

Note: The M2 fires a recommended 5-7 round burst.
**EST 2000 Heavy Weapons TEA*

Table 11. MK19 qualification average number of hits (out of 10) (from Hughes & Nau, 2008)

Location	Qualification Rounds Per Firer	Group I Live Training		Group II Familiarization Fire + EST Training		Group III ST Training		Total Firers
		Number	Hits	Number	Hits	Number	Hits	
Fort Sill	62	12	9.62	12	8.33	10.00	8.00	34
Fort Benning	62	11	9.82	12	8.33	12.00	9.58	35
Total		**23**	**9.74**	**24**	**8.33**	**8.86**	**22.00**	**69**

Note: The MK19, which fires a recommended 3-5 round burst, is an area suppression weapon with a personnel casualty-producing radius of 15 meters from impact.

ITEAM identified the same shortcomings with the EST 2000 that were noted in the TEA by soldiers and their instructors. The shortcomings were the visibility of targets and weapons effects, the inability to properly clear both weapons and the inability to replicate environmental factors (i.e., heat, cold, wind, rain). None of these factors impacted the EST 2000's ability to support deliberate practice or live fire qualification. Additional comments made by instructors and firers captured in the original TEA tended to deal with shortcomings in the weapons training program and not the EST 2000 itself. One such comment dealt with the importance of hands-on, non-firing training to assist with soldier proficiency in using the weapons in combat (Hughes & Nau, 2008). Our ITEAM assessment did not examine the initial-entry training (IET) weapons training program.

C. CONCLUSIONS

Comparing the results of the survey data from the EST 2000 TEA and the ITEAM assessment reinforces our claim that a process using affordances as a way to predict ITE utility is effective. Using ITE affordances based on human abilities and specific tasks provides a reasonably reliable way of predicting ITE support to training. Evaluation of the EST 2000 using ITEAM further demonstrates that the structured analytical methodology and processes incorporated within ITEAM are reliable and may be used effectively to assess and determine ITE utility.

VII. DISCUSSION

This dissertation began with an introduction to the culture of Army training and highlighted a situation where the efficacy of training may be questionable based on the knowledge of those called upon to lead and conduct a unit's training program. We then conducted an investigation of the literature dealing with training. This review highlighted many but not all of the pieces of the training puzzle. We learned about how the initial piece of the Joint Capabilities Integration Development System (JCIDS) works and how, over time, the system has become less effective in the support of ITE development. There was a great deal of discussion about front-end analysis and its impact on ITE development and success. The discussion highlighted the importance of task analysis and that the development of training objectives is rarely done. The positive and negative influence of SMEs on ITE development, with respect to fidelity and bias were discussed and, while controversial, it was recognized that SMEs have a very important role to play in the training puzzle. We spent considerable time discussing transfer of training (TOT). TOT is recognized by many as the ultimate way to determine effectiveness of ITEs. We highlighted the inherent difficulties and flaws in relying solely on TOT as the means for determining ITE effectiveness.

From the outset of this research, we recognized that any analytical assessment of an integrated training environment (ITE), however effective it may be, would never lead to crisp results about transfer of training (TOT) like a well-developed and executed empirical TOT study. Conversely, there was also recognition that empirical evaluation of ITEs is not being conducted for many reasons including cost and difficulty in obtaining informative data. Lastly, we learned that even when empirical TOT studies are performed, they might not be what they appear to be. In many cases, inferences about transfer are made based on data that is not grounded in performance. We suggest that this is minimally useful at best and misleading at worst. We surmise that both of these reasons directly relate to why the empirical evaluations that are being conducted result in weak or inconclusive results.

The literature review drew to a close beginning with a discussion on the various ways simulations have been analytically evaluated inside and outside of the training domain. The review was informative as it showed that the state of the art in analytical assessment is not all that good. Review of the training simulation assessment literature assisted us in shaping our methodology and in avoiding common pitfalls.

We concluded the literature review by discussing the USA training effectiveness analysis (TEA) system. This system formerly provided the policy and regulation over TEA studies conducted to determine the cost and effectiveness of training programs and ITEs. The discussion pointed out one very important item that was repeatedly seen throughout this research. The TEA system did not prescribe how TEAs should be conducted, nor did it constrain analyst's methods for reaching their conclusions. Carter (1982) made the point that the lack of detailed guidance on how to conduct a TEA was a threat to the accuracy of the results. Simpson (1995) refuted this idea indicating that providing a cookbook to do TEAs would result in skepticism of the results by anyone outside of the DOD. Based on our experience with the several TEAs used for this research and others that were reviewed but not included, we would strongly argue in support of Carter's position. The lack of specific guidance was recognized as a failure of the system in several of the TEAs we analyzed. While the use of appropriate statistical methods were always employed, it was rare to see appropriate data used in support of the conclusions drawn from the statistical methods. The lack of prescriptive guidance to include investigation of the actual ITE has resulted in a wide spread of techniques used to justify ITE effectiveness most often divorced from the actual ITE under investigation. We are discouraged by the elimination of the TEA system, but we are even more discouraged by what we have seen produced and labeled as TEA studies used to support decision making in the material acquisition process (MAP).

We set out with an objective to investigate the current state of the art of analytical assessment of ITEs with the belief that there had to be a way to determine ITE utility that fell somewhere on the analysis spectrum between doing nothing and useful empirical evaluation. Furthermore, we believed that an analytical solution based on human abilities and affordance theory instead of just technology would provide a solid foundation to

start. We developed ITEAM based on the information and lessons learned from the literature and a systematic approach to problem solving taught within the systems engineering discipline. Several lessons were learned during this process about ITEAM and its application. First and foremost, domain experience is necessary in order to use ITEAM effectively. A lack of domain experience or knowledge can result in a situation where the results of an analysis falsely indicate a situation that an ITE fully supports training when it does not. Without domain knowledge and experience, an essential understanding of the necessary ITE affordances does not exist and cannot be determined appropriately.

The consistent application of ITEAM mitigates the effects of evaluator bias. During the assessments of FSC and VBS2, we recognized instances where our own bias interfered with our assessment of the ITE in question. With FSC, we recognized that in at least one instance we treated two similar affordances in two different analyses inconsistently. This resulted in an inflated rating for one of the analyses and a conflict. Taking the time to draft a study plan, rules for ITE examination and the handling of unique and similar situations reduces the level of SME subjectivity (bias) involved in using ITEAM. During our evaluation of VBS2, we again recognized our bias, this time against a game's ability to provide a useful practice environment for physical tasks. Recognizing that this situation occurred while using a logical process provided us insight into how evaluator bias impacts assessment when a methodology like ITEAM is not used. We believe that bias is but one of several "elephants in the room" during TEA.

ITEAM development was grounded in the logic of systems engineering and human abilities, which have demonstrated evolutionary stability for over 40 years. Through the use of this methodical process we re-examined three TEA studies that included games and virtual training simulators. In each study, ITEAM demonstrated a level of success in predicting the utility of the ITE to support the deliberate practice of tasks. While we are not going to reiterate the analysis done within each study, we will reiterate that based on the results of these studies we are confident asserting that the application of an analytical methodology to evaluate ITE utility in support of the deliberate practice of skills is useful.

The debate over the value of analytical assessment of ITEs will continue but we believe that our efforts have shed light on a new way to approach the issue. Implementing a methodical process in assessment efforts forces an accounting of things that the current acquisition process ignores or bypasses. Each process and sub-process of ITEAM unlocks information about the stakeholder's needs and ITE requirements that otherwise might be missed if the methodology was not followed. Furthermore, given that the cost of using the methodology is so small, it will result in cost savings of time and money in the areas of design, development and manufacturing of ITEs.

We suggest that a similar situation exists today as was seen in graphical user interface (GUI) design a decade ago. A great deal of effort at that time was placed on the research and development of how to make better GUIs. Much of this work was empirical in nature. Techniques were proposed, interfaces were designed and developed, and then they were tested with real users. That work resulted in methodologies and standards that guide GUI design and development today. Where user testing was the norm a decade ago, today it is used in a very focused fashion and sparingly. Much of the time, good interfaces are developed using guidelines that emerged from empirical research without conducting empirical user tests. This result is due to the recognition that when proven and stable methodologies are used during development, good GUIs will result. We want this result for training systems. Based on that model, we suggest that the acquisition community include ITEAM in their existing design, development and testing processes to establish and refine it. In doing so over time, the need for empirical testing of ITEs may be better scoped, reduced and possibly eliminated.

VIII. CONCLUSIONS AND FUTURE WORK

A. CONCLUSIONS

Based on the TEAs we have reviewed and re-analyzed, it is apparent that the issue of candor described in Paolozzi (2013) also effects ITE effectiveness analysis. Use of broad declarations within formal studies to validate ITEs is fueled by several desires. The stakeholder's desire is that the ITE positively support the desired training necessary to prepare soldiers for waging war. The acquisition community's desire is to demonstrate that the management of the ITE program was responsible and correct. Both desire a positive outcome so as to avoid being the bearer of bad news to Congress or USA leadership that the return on investment for the ITE is indeterminable or worse, negative. This desire is perhaps the strongest of them all. Millions of dollars are spent annually on ITEs in the military acquisition process (MAP). Thousands more are spent to justify that millions were not wasted. In many cases studies carefully designed to answer questions about utility fail to examine the ITEs in question. The studies ask the wrong questions and use data obtained from non-relevant areas to support hypotheses of system utility. Aside from providing a shield to block criticism or a crutch to steady the doubtful, these studies do very little to help us know what our ITEs actually support.

Implementation and use of ITEAM throughout the system lifecycle prevents a situation where after the fact TEAs provide a negative outcome that is unpalatable. Using ITEAM provides developers and decision makers with windows of opportunity to make decisions impacting ITE design and development, before serious money has been committed.

The Army needs to reinvigorate the TEA system by adopting a methodology for evaluating ITEs and training programs. Elimination of the TEA system in the face of budget pressures has created a policy void and lack of guidance and experience for determining ITE utility. Millions of dollars have been spent in efforts to design, develop and field ITEs that allow military forces to maintain established proficiencies and gain new ones. Without policy to guide assessment efforts, millions of dollars may be wasted.

The calls for proof that ITEs are worth the money being spent on them are increasing (GAO, 2013). The training domain’s ability to develop and apply specific measures of performance (MOP) and effectiveness (MOE) to the study of human performance has improved over the past several decades. Unfortunately, practical application of MOP and MOE remain inadequate for the task of determining ITE utility. Reliance on subject matter experts (SMEs) to provide insight into ITE utility remains constant. Suggestions to eliminate the use of SMEs are as ignorant as expecting any single SME to provide all of the answers to questions about ITE utility.

The results of this research have revealed several things. First and foremost is that an analytical assessment methodology based on human abilities and affordance theory can be used to predict task elements where training transfer is most likely to be found. Second, domain subject matter expertise is necessary when conducting an evaluation of an ITE but that expertise is only useful when it is focused appropriately rather than broadly. SME bias and overconfidence exists. Continued evaluation of ITE utility without the use of some form of logical normalizing “hand rail” like ITEAM will result in the status quo. Providing domain experts with a tool like ITEAM that allows them to move away from a single question of “how good is the ITE,” towards guided analysis is what is being suggested. The use of ITEAM provides SMEs with a tool to parse an ITE to an atomic level where they may apply their expertise appropriately. Specific questions of ITE utility that an SME has direct experience with may be answered with ease. The challenge is to place SMEs in positions where their expertise may be applied responsibly, where they are asked questions that they are best qualified to answer, and to provide them with a tool that allows them to dissect an ITE into reasonable pieces so that they may apply their knowledge and experience appropriately.

Since ITEAM does not attempt to determine appropriate levels of fidelity for system affordances, it cannot be relied upon to answer questions about the quality of the affordances in the ITE. ITEAM only provides insight as to whether or not specific affordances are available. With that information, a generalized rating of ITE support for training is provided. This research approached all affordances as being equal. Reality demonstrates that some things are more important than others, so a way of factoring that

into the evaluation and scoring process of the methodology is necessary. Finally, the current way we go about assessment using vague or broadly scoped questions is not useful. Decision makers and analysts alike must be more diligent in formulating the specific questions that they require answers for. Taking time early to conduct thorough front-end analysis is not time wasted. Rather it results in a time savings and prevents all of us from having to redo analysis that is inconclusive.

B. FUTURE WORK

Initial enhancement work is needed in the scoring area of ITEAM to account for and provide emphasis on those items that are deemed "critical" ITE affordances. One suggestion is the integration of value modeling and the application of weighting to both affordances and tasks. We believe that enhancing ITEAM in this way will better align it with the current reality that recognizes all things are not held equally. Some tasks and some affordances are simply more important to a stakeholder than others. As it stands, ITEAM treats all tasks and affordances equally. This was necessary considering that there were no obvious attempts to weight tasks or ITE characteristics in the studies reexamined using ITEAM.

As with every new development, more testing is always desirable. As described, ITEAM has the capability to assist in the requirements definition, verification and assessment phases of the material acquisition process (MAP). Documented implementation of ITEAM in a new or ongoing acquisition program and/or the application of ITEAM to other previously evaluated systems would help to solidify the approach and help in discovering any serious shortcomings that may have been missed during this initial research effort.

This dissertation focused on the development of a methodology that can be used to determine ITE utility to support the deliberate practice of specific tasks. We demonstrated the reliability and consistency of the process using three distinct case studies employing three different ITEs. We did not attempt to investigate or measure the inter-rater reliability (IRR) of using the methodology due to time constraints and the belief that consistency and reliability should come first. A recommendation for future

work is to establish IRR using ITEAM. We believe that doing so is a logical next step to continue the work started here.

Ease of use and implementation difficulty are two reasons why analytical assessment methodologies are discounted or discarded. A suggestion for future work is to automate the ITEAM process. The potential trap with automation is that by automating the processes, the methodology becomes too difficult for the layman to use. Care should be taken to ensure that the integrity of the form of the process does not fall prey to the automation of the function of the process. At a minimum, automation of the scoring procedure for the methodology would be a significant help to those who may implement this technique in large ITE projects.

Upon reading an IITSEC best paper in 2013 on aural visual data (Napoletano, 2013), it became evident to us that including this type of capability into ITEAM would be very powerful. Often, sound provides insight into a situation. Rotary aviators commonly speak about determining aircraft problems based on the sounds in the cockpit. Within ITEAM sound may be accounted for but determining the appropriate quality is currently impossible. Work done by Napoletano (2013) could change that limitation and provide an opportunity to integrate affordance quality into the discussion of ITE utility and ITEAM.

After three years of investigating and working with human abilities, it occurred to us that there is no human ability representation for smell or taste. Several cognitive abilities could possibly be used to explain smell and taste but we believe that given the number of occupations that rely on smell and taste, these two abilities should be investigated as described by Fleishman and Quaintance (1984) and added to the taxonomy of 52 human abilities.

Finally, we recommend that the Army reconsider the decision to eliminate the TEA system. We recommend that a review of the organization and system take place with a goal of implementing a better process. The TEA system provided structure to the conduct of training effectiveness analysis studies. It lacked prescriptive guidance on the proper approach to ITE assessment. Elimination of redundant analytical bureaucracy (the

division of TRAC-WSMR that oversaw the TEA system) may make sense, but standards, structure and guidance for ITE assessment are still required.

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APPENDIX A. HUMAN ABILITIES

Human Abilities List		
*From Ability Measurement in DOL's Occupational Information Network (O*NET) A Factorial Approach by Edward J. Hester and VYTO Baltrukenas		
Grouping*	**Ability**	**Ability Description**
Cognitive-Verbal	Oral Expression	The ability to communicate information and ideas in speaking so others will understand.
Cognitive-Verbal	Oral Comprehension	The ability to listen to and understand information and ideas presented through spoken words and sentences.
Cognitive-Verbal	Written Comprehension	The ability to read and understand information and ideas presented in writing.
Cognitive-Verbal	Written Expression	The ability to communicate information and ideas in writing so others will understand.
Cognitive -Idea Generation and Reasoning	Deductive Reasoning	The ability to apply general rules to specific problems to produce answers that make sense.
Cognitive -Idea Generation and Reasoning	Fluency of Ideas	The ability to come up with a number of ideas about a topic (the number of ideas is important, not their quality, correctness, or creativity).
Cognitive -Idea Generation and Reasoning	Inductive Reasoning	The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).

Cognitive -Idea Generation and Reasoning	Originality	The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.
Cognitive -Idea Generation and Reasoning	Problem Sensitivity	The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
Cognitive -Idea Generation and Reasoning	Information Ordering	The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
Cognitive -Idea Generation and Reasoning	Category Flexibility	The ability to generate or use different sets of rules for combining or grouping things in different ways.
Cognitive-Quantitative	Mathematical Reasoning	The ability to choose the right mathematical methods or formulas to solve a problem.
Cognitive-Quantitative	Number Facility	The ability to add, subtract, multiply, or divide quickly and correctly.
Cognitive-Spatial	Visualization	The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.
Cognitive-Spatial	Spatial Orientation	The ability to know your location in relation to the environment or to know where other objects are in relation to you.
Cognitive-Perceptual	Flexibility of Closure	The ability to identify or detect a known pattern (a figure, object, word, or sound) that is hidden in other distracting material.

Cognitive-Perceptual	Speed of Closure	The ability to quickly make sense of, combine, and organize information into meaningful patterns.
Cognitive-Perceptual	Perceptual Speed	The ability to quickly and accurately compare similarities and differences among sets of letters, numbers, objects, pictures, or patterns. The things to be compared may be presented at the same time or one after the other. This ability also includes comparing a presented object with a remembered object.
Cognitive-Memory	Memorization	The ability to remember information such as words, numbers, pictures, and procedures.
Cognitive-Attentiveness	Selective Attention	The ability to concentrate on a task over a period of time without being distracted.
Cognitive-Attentiveness	Time Sharing	The ability to shift back and forth between two or more activities or sources of information (such as speech, sounds, touch, or other sources).
Sensory-Visual	Night Vision	The ability to see under low light conditions.
Sensory-Visual	Peripheral Vision	The ability to see objects or movement of objects to one's side when the eyes are looking ahead.
Sensory-Visual	Glare Sensitivity	The ability to see objects in the presence of glare or bright lighting.
Sensory-Visual	Depth Perception	The ability to judge which of several objects is closer or farther away from you, or to judge the distance between you and an object.

Sensory-Visual	Far Vision	The ability to see details at a distance.
Sensory-Visual	Near Vision	The ability to see details at close range (within a few feet of the observer).
Sensory-Visual	Visual Color Discrimination	The ability to match or detect differences between colors, including shades of color and brightness.
Sensory-Auditory and Speech	Auditory Attention	The ability to focus on a single source of sound in the presence of other distracting sounds.
Sensory-Auditory and Speech	Speech Clarity	The ability to speak clearly so others can understand you.
Sensory-Auditory and Speech	Speech Recognition	The ability to identify and understand the speech of another person.
Sensory-Auditory and Speech	Hearing Sensitivity	The ability to detect or tell the differences between sounds that vary in pitch and loudness.
Sensory-Auditory and Speech	Sound Localization	The ability to tell the direction from which a sound originated.
Psychomotor-Fine Manipulative	Arm-Hand Steadiness	The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.

Psychomotor-Fine Manipulative	Manual Dexterity	The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
Psychomotor-Fine Manipulative	Finger Dexterity	The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.
Psychomotor-Control Movement	Control Precision	The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
Psychomotor-Control Movement	Response Orientation	The ability to choose quickly between two or more movements in response to two or more different signals (lights, sounds, pictures). It includes the speed with which the correct response is started with the hand, foot, or other body part.
Psychomotor-Control Movement	Rate Control	The ability to time your movements or the movement of a piece of equipment in anticipation of changes in the speed and/or direction of a moving object or scene.
Psychomotor-Control Movement	Multilimb Coordination	The ability to coordinate two or more limbs (for example, two arms, two legs, or one leg and one arm) while sitting, standing, or lying down. It does not involve performing the activities while the whole body is in motion.
Psychomotor-Reaction Time and Speed	Wrist-Finger Speed	The ability to make fast, simple, repeated movements of the fingers, hands, and wrists.
Psychomotor-Reaction Time and Speed	Reaction Time	The ability to quickly respond (with the hand, finger, or foot) to a signal (sound, light, picture) when it appears.
Psychomotor-Reaction Time and Speed	Speed of Limb Movement	The ability to quickly move the arms and legs.

Physical-Strength	Static Strength	The ability to exert maximum muscle force to lift, push, pull, or carry objects.
Physical-Strength	Explosive Strength	The ability to use short bursts of muscle force to propel oneself (as in jumping or sprinting), or to throw an object.
Physical-Strength	Dynamic Strength	The ability to exert muscle force repeatedly or continuously over time. This involves muscular endurance and resistance to muscle fatigue.
Physical-Strength	Trunk Strength	The ability to use your abdominal and lower back muscles to support part of the body repeatedly or continuously over time without 'giving out' or fatiguing.
Physical-Stamina	Stamina	The ability to exert yourself physically over long periods of time without getting winded or out of breath.
Physical-Flexibility, Balance and Coordination	Extent Flexibility	The ability to bend, stretch, twist, or reach with your body, arms, and/or legs.
Physical-Flexibility, Balance and Coordination	Dynamic Flexibility	The ability to quickly and repeatedly bend, stretch, twist, or reach out with your body, arms, and/or legs.
Physical-Flexibility, Balance and Coordination	Gross Body Coordination	The ability to coordinate the movement of your arms, legs, and torso together when the whole body is in motion.
Physical-Flexibility, Balance and Coordination	Gross Body Equilibrium	The ability to keep or regain your body balance or stay upright when in an unstable position.

APPENDIX B. EXAMPLE QUESTIONS USED DURING ITEAM APPLICATION

The following questions are the kind asked during each of the sub-phases of each of the main processes of ITEAM. This list is not exhaustive.

A. REQUIREMENTS DEFINITION

1. Definition of the Need

- What is the problem or capability gap?
- Is this a training system problem? Is an ITE the answer to the problem?
- Can our existing ITEs address this or what is missing in our current ITE solutions?
- Can we define successful execution in measurable ways?
- What does success look like in terms of the need?

2. Operational Concept/Functional Allocation

- Where does this "thing" fit into our existing training program(s)?
- What stage of training are we in (crawl, walk, run)?
- Do we need a part task device or a whole environment? What's the vision?
- What do we want trainees to do with/in the ITE?
- What are our expectations of trainee performance? How will we measure?
- What is the setting where this ITE will be used (classroom, field)?
- What aspects of the problem (need) do we want to offload to the ITE?
- What aspects of the ITE drive trainee response?
- What kinds of responses/actions do we want trainees to practice?

3. Task Analysis/Learning Objectives

- What are our desired training/learning outcomes?
- What tasks can be derived from our training objectives?
- Which tasks are the most critical?
- Which tasks do we want the ITE to support the practice and execution of?
- What is the best approach for us to use to describe tasks and their execution?

- Does the level of task description allow us to easily identify the human abilities involved in the execution of the task?
- Are the tasks broken down to a level where we can describe the necessary characteristics of the environment (affordances)?

4. Real World Human Ability Inventory

- Is this task cognitive, physical, sensory or psychomotor in nature?
- What abilities do we think are involved with this task?
- What kind of activity is involved with this task/mission?
- In what kind of situations might this task be executed?
- What are the most important human abilities involved with the practice of the tasks?

5. Real World Affordance Requirements

- What do we have to have in the environment in order to stimulate the human abilities listed for the task?
- Have we described the affordances appropriately? Does our description point to a solution or a specification for a solution?
- Have we described the affordances in a quantifiable manner?
- Where does the activity occur? (i.e., what kind of natural environment or weather conditions).
- Is the natural environment important to the practice of the task?
- Is equipment involved?
- Does equipment have to be in the ITE in order for the practice of the tasks to occur?
- Do affordances have to be high fidelity for the practice of the tasks?

B. VERIFICATION OF ENVIRONMENT

1. Determine ITE HA

- What human abilities does this ITE support?
- How does a trainee perform the task in the ITE?
- Are the required abilities supported?
- What non-essential abilities are supported?

- What does the ITE HA supported list tell us about how we should use the ITE?
- Do the non-essential HA's support other aspects of our training program that are important?
- Can we leverage the ITE for reasons not originally planned?

2. Determine ITE Affordance Resources

- What does the ITE contain?
- What are the characteristics of the ITE?
- At a minimum, does the ITE have affordances we believe are required?
- What non-essential affordances exist?
- Can non-essential affordances be useful in supporting other aspects of our training program?
- Do non-essential affordances negatively impact practice?
- Is the fidelity level of the affordances acceptable to support practice?

C. ASSESSMENT

- Does the ITE contain the necessary affordance resources?
- Do we have a plan for treating the same or similar affordances equally?
- Do we have a plan for reconciling conflicts due to our bias?
- Do we recognize the HA supported by the ITE and what that means in terms of the types of practice that can be supported?
- Have we listed the affordances in a manner where they may be quantified?
- Do we understand the scoring process?
- Do we have a plan for how we will document the process so that we may accomplish the scoring and evaluation?

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APPENDIX C. CONCEPT OF OPERATION USED DURING VBS2 TRAINING AT FORT HOOD

The following slide depicts a basic mission concept that was used for unit training at Fort Hood, Texas during the time of the game-based training effectiveness TEA. This concept of operations (CONOP) was provided to units who were then allowed to modify it based on their own training objectives.

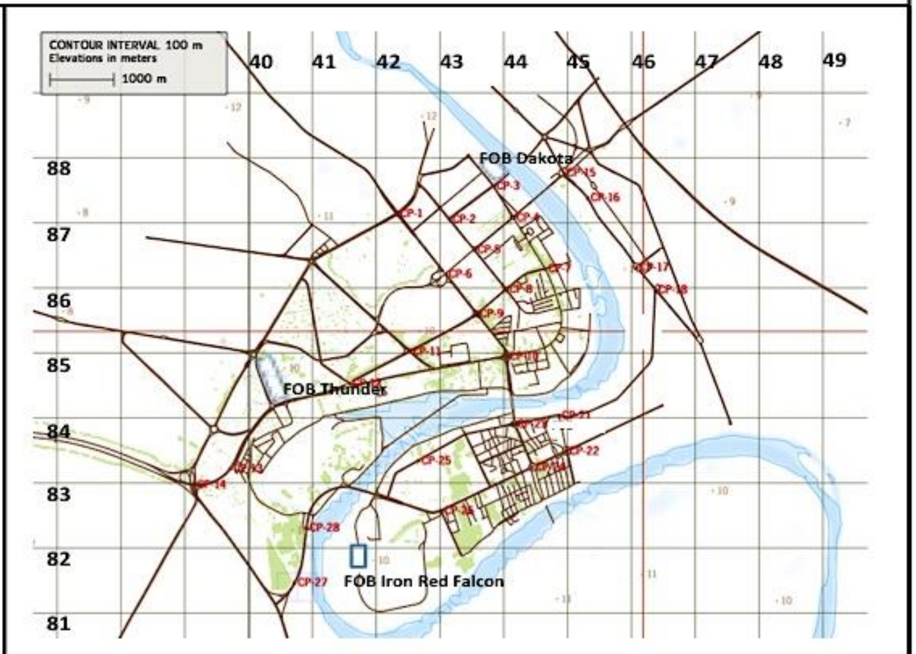
BAGHDAD – SECURITY OPERATIONS

SITUATION:

Terrain:
Varied terrain transitioning from rolling high desert to lush green zone just north of the city Baghdad.

Friendly:
CF units are located at FOB THUNDER . No other units are expected in sector. Minimal ANP units are in sector at various checkpoints.

Enemy:
Elements of the Baathist and Shiite Militia are attempting to disrupt CF operations in Baghdad province. Recent reports indicate 5-10 man elements armed with AKs, RPKs, and RPGs emplacing IEDs with over watch positions capable of ambushing if a unit is stalled by an IED.



EXECUTION:

Maneuver:
Use movement techniques appropriate with the threat level.

Fires:
Indirect fires are prohibited from use in urban areas.

Coordinating Instructions:
Conduct rehearsals prior to SP.
Report all Checkpoints.
Report halts and other incidents.
The enemy must be positively identified prior to engagement.
Take necessary measures to preserve civilian lives.

SERVICE AND SUPPORT:

CASEVAC:
IAW Unit SOP

Vehicle Recovery:
IAW Unit SOP

COMMAND AND SIGNAL:

Succession of Command: IAW Unit SOP

EOD call sign: "Sapper "
Air MEDEVAC call sign: "Dust Off"
Ground MEDEVAC call sign: "Evac 16"
QRF call sign: "Gunslinger 44"
CAS call sign: "Outlaw 16"

MISSION:

Conducts area security operations vicinity Baghdad IOT disrupt insurgent movement in Baghdad province.

RISK ASSESSMENT:

Your unit assumes risk by operating in a new area of Baghdad province without a RIP.

COMMANDER'S INTENT:

Purpose:
Disrupt the flow of enemy forces in and around Baghdad to allow time for the IP to establish a presence.

Key Tasks:
-Safe conduct of all movements
-Decisive action against any enemy forces
-Ensure proper PID and the use of EOF with consideration toward the local populace

End state:
Unit manned at 100% strength, insurgents operating in the area destroyed, and Baghdad secured by IP.

CONCEPT OF THE OPERATION:

Task: Move to and stage at RP

PIR:
-Enemy contact
-Mines encountered
-IP checkpoint: grid, number of IP manning

FFIR:
-Loss of any sensitive item
-Any vehicle becomes NMC
-Injury to any soldier

Time	Event
	Receive Mission
	Issue Warning Order
	Make a Tentative Plan
	PCC/PCI
	Recon/TiGR Update
	Issue Order
	Back Briefs
	SP Report
	EOM AAR
	RP Destination
	AAR
	TiGR Update

APPENDIX D. ANALYSIS OF VBS2

The following pages contain the assessment worksheets from the ITEAM analysis of VBS2 in support of this research effort.

SCORE: 5.00 Excellent

High Level Task: React to Attack (Near or Far)

Doctrine: STP 21-1 SMCT (Task 071-COM-3001 React to Direct Fire While Mounted), Training and Evaluation Outline for Task 07-3-9013 Conduct action on contact

Preconditions: Soldiers are familiar with the individual and collective react to attack (contact) battle drills for various types of threats (e.g., missile, indirect fire, direct fire, IED).

Tasks:

1. Elements caught in the kill zone, return fire and use smoke to conceal their movement and maneuver to assault through the ambush.
2. Elements not caught in the kill zone, provide "well aimed" suppressive fire on enemy from a support by fire position.
3. Element leader coordinates/adjusts indirect fire/close air support for elements in the kill zone.
4. Support by fire elements lift and shift their suppressive fire as the elements in the kill zone assault through the enemy positions to destroy them.
5. Leader reports actions to the CoC.

Post-conditions: Attack is defeated. Area secured command informed. Casualties assessed and immediate buddy aid performed.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis

3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Real World (RW) Preconditions: Soldiers are familiar with the individual and collective react to attack (contact) battle drills for various types of threats (e.g., missile, indirect fire, direct fire, IED).			**Environmental Evaluation** Focus included both mounted and dismounted operations for this task.		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Elements caught in the kill zone, return fire and use smoke to conceal their movement and maneuver to assault through the ambush.	**COGNITIVE:** Oral Expression; Oral; Comprehension; Originality; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation;	– Enemy forces – Enemy Direct/Indirect fire – Urban or Suburban environment containing areas from which to conduct an ambush and respond to an ambush containing natural and manmade elements. – Weather effects (i.e., heat, rain, dust, cold) – Personal protective equipment and weapons (i.e., helmet, IBAS, LBE, M4) – Ammunition (personal weapon and crew served) – Crew served weapons – Appropriate military vehicles with mounted crew served weapons – Chain of Command – Smoke grenades (various colors) or vehicle smoke generating system – FM/Digital Communication	**COGNITIVE:** Oral Expression; Oral Comprehension;; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; **PSYCHOMOTOR:** Manual Dexterity; Response Orientation; Multilimb Coordination; Reaction Time **PHYSICAL:** None	– Affordances Present	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Rate Control; Multilimb Coordination; Reaction Time; Speed of Limb Movement; **PHYSICAL:** Static Strength; Explosive Strength Dynamic Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	equipment (redundant) – Communications link with other elements of unit/leader – Night vision devices/optics – Stereo sound of gunfire, indirect fire, other types of explosives – Muzzle flashes – Friendly forces – Weapon projectile effects			
Elements not caught in the kill zone, provide 'well aimed' suppressive fire on enemy from a support by fire position.	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech	– Support by fire element – Support by fire location – Urban or Suburban environment containing areas from which to conduct an ambush and respond to an ambush containing natural and manmade elements. – Weather effects (i.e., heat, rain, dust, cold) – Crew served and personal weapons – Friendly force – Smoke grenades (various colors) or vehicle smoke – Ammunition	**COGNITIVE:** Oral Expression; Oral Comprehension;; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; **PSYCHOMOTOR:** Manual Dexterity; Response Orientation;	– Affordances present	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Recognition; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination; Reaction Time; Speed of Limb Movement; **PHYSICAL:** Static Strength; Explosive Strength Dynamic Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	– Distance/Direction to orient fires on – Indirect fire if available – CAS if available – Military Vehicles with crew served weapons mounted – FM/Digital Communication equipment (redundant) – Communication link with other elements of unit/leader – Night vision devices, crew served and/or personal weapons optics – Weapon projectile effects	Multilimb Coordination; Reaction Time **PHYSICAL:** None		
Element leader coordinates/adjusts indirect fire/close air support for elements in the kill zone.	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization;	– Chain of command – FM/Digital communication equipment – Communications link to elements in contact and higher HQ – Indirect fire assets and effects to adjust – Close air support assets to direct/adjust – Results of close air	**COGNITIVE:** Oral Expression; Oral Comprehension; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Speed of Closure; Memorization; Time Sharing; **SENSORY:**	– Affordances Present	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Multilimb Coordination; **PHYSICAL:** Extent Flexibility;	support – Kill zone – Elements in kill zone – Stereoscopic sounds of battle (indirect, small arms, machine guns) – Urban or Suburban environment containing areas from which to conduct an ambush and respond to an ambush containing natural and manmade elements. – Binoculars/optics – Weather effects (i.e., heat, rain, dust, cold) – Weapon projectile effects	Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Multilimb Coordination; **PHYSICAL:** None		
Support by fire elements lift and shift their suppressive fire as the elements in the kill zone assault through the enemy positions to destroy them.	**COGNITIVE:** Oral Expression; Oral Comprehension; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Time Sharing; **SENSORY:**	– Support by fire element – Assault element – Urban or Suburban environment containing areas from which to conduct an ambush and respond to an ambush containing natural and manmade elements. – Vehicles with crew served weapons	**COGNITIVE:** Oral Expression; Oral Comprehension;; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:**	– Affordances present	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **<u>PSYCHOMOTOR:</u>** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination; Reaction Time; Speed of Limb Movement; **<u>PHYSICAL:</u>** Static Strength; Explosive Strength Dynamic Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	mounted – Personal weapons and protective gear – Ammunition – Smoke – Night Vision Devices/Weapon optics – Binoculars – Enemy forces – Enemy weapons effects – FM/Digital communication equipment – Communication link with element in kill zone – Weather effects (i.e., heat, rain, dust, cold) – Weapon projectile effects	Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Response Orientation; Multilimb Coordination; Reaction Time **<u>PHYSICAL:</u>** None		
The unit leader reports the contact to higher headquarters.	See coordinate activities with CoC	See coordinate activities with CoC	See coordinate activities with CoC	See coordinate activities with CoC	3 tasks all rated 5

Post-conditions:
Enemy destroyed or contact broken. Original mission continues

SCORE: 5.00 Excellent

High Level Task: React to a possible static IED/VBIED while mounted/dismounted

Doctrine: stp21-1-2011; Individual Task 052-COM-1270; React to and IED Drill 05-3-D1703

Preconditions:

Task:
1. Alert members of the element to the possible IED/VBIED and its location using the 3 Ds (direction, distance, description).

2. Establish security; scan for possible secondary/tertiary IEDs/VBIEDs using the 5/25/100 meter checks.

3. Conduct the 5 Cs—these can be done concurrently (check, confirm, clear, cordon, control)

CHECK—All personnel should check their immediate area for secondary/tertiary devices.

CONFIRM—The unit MUST confirm the existence of a suspected IED from a safe distance. Once confirmed, the unit calls in an EH SPOTREP and requests Explosive Ordnance Disposal (EOD).

CLEAR—The unit clears the area around the device of all personnel, working from the device outwards.

CORDON—Establish a security cordon around the danger area by setting up blocking positions to prevent foot and vehicle traffic from approaching the IED.

CONTROL—The unit must control the area inside the cordon to ensure authorized access.

4. Leader contacts and submits reports according to the unit's standard operating procedure (SOP).

Post-conditions: Area secure; higher headquarters/EOD informed

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Real World (RW) Preconditions:			Environmental Evaluation		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Alert element: direction, distance, description	**COGNITIVE:** Oral Expression; Problem Sensitivity; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Speech Clarity; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Reaction Time; **PHYSICAL:** Extent Flexibility;	– FM/Digital Communication equipment (redundant) – Communications link with other elements of unit/leader – Urban or Suburban environment containing areas from which to conduct an ambush and respond to an ambush containing natural and manmade elements. – Weather effects (i.e., heat, rain, dust, cold) – Personal protective equipment and weapons (i.e., helmet, IBAS, LBE, M4) – Ammunition (personal weapon and crew served) – Crew served weapons – Appropriate military vehicles with mounted crew served weapons	**COGNITIVE:** Oral Expression; Oral Comprehension; Problem Sensitivity; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; **SENSORY:** Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Multilimb Coordination; Reaction Time; **PHYSICAL:** None	– All present	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

		– Chain of Command – Observable IED threat or indicator of possible IED threat – A way to determine direction and distance (compass, GPS, Weapon sight, laser range finder, binoculars etc) – Night vision devices			
Establish security and scan for other devices using the 5/25/100 method	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization;	– Vehicles with crew served weapons mounted – Personnel with weapons and equipment – Ammunition – Vehicle optics – Weapon Optics – Weather/Climate conditions – Urban or suburban location/environment with sprawl – Orders from a leader – Location to create a security perimeter – Potential or observed threat/enemy – A way to determine direction and distance (compass, GPS, Weapon sight, laser range finder, binoculars etc)	**COGNITIVE:** Oral Expression; Oral Comprehension; Problem Sensitivity; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Multilimb Coordination; **PHYSICAL:** None	– All Present	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	PSYCHOMOTOR: Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination; Reaction Time; **PHYSICAL:** Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	– FM/Digital communication equipment – Chain of command			
Check the 5 C's – Check, Confirm, Clear, Cordon, Control	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Category Flexibility; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity;	– Suspected device or threat – Personal weapons and personal protective equipment – Military vehicles – Crew served weapons – Ammunition – Materials to make obstacles from (e.g., wire, barriers, cones) – Means of FM/Digital communication – 360 degree field of view from device outward – Team members – Chain of Command	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Problem Sensitivity; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY** Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity;	– Threat – POW/PPE – Vehicles – Crew Served weapons – Ammo – No materials to make obstacles – FM Comms via headsets – Avatars have 360 degree visibility – AI scripted team members possible as well as other unit members – CoC – Urban/Suburban environment	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor 13 of 14

	Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Rate Control; Multilimb Coordination; Wrist-Finger Speed **PHYSICAL:** Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	– Urban or Suburban environment (e.g., buildings, roads, houses, farms, overpasses, etc) – Various Weather conditions (rain, heat, dust) – Night vision devices/optics – A means of marking areas that have been cleared	Multilimb Coordination; **PHYSICAL:** None	– Weather replicated – NVG Optics – Chemlights available for marking	
Leader contacts and submits reports according to the unit's standard operating procedure (SOP).	See coordinate activities with higher HQ	See coordinate activities with higher HQ	See coordinate activities with higher HQ	See coordinate activities with higher HQ	3 tasks all rated 5
Post-conditions:					

SCORE: 3.77 Very Good

High Level Task: Conduct Recovery Operations

Doctrine: ATP 4-25.13; Individual Task 081-833-0227 Coordinate Casualty Treatment and Evacuation

Preconditions: IED or other event has occurred and rendered a vehicle or vehicles in need of recovery.

Task: Recover Vehicle

1. Determine if the vehicle can be recovered and repaired, or if it should be abandoned or destroyed.
    a. Visually inspect damaged vehicle
    b. Physically inspect damaged vehicle
2. Forward the battle damage report to higher headquarters.
3. Determine requirements for recovery.
    a. Determine if the vehicle can be rapidly repaired and continue the mission.
    b. Determine if the vehicle can be moved using organic assets.
    c. Select recovery equipment and personnel in accordance with mission and capability.
    d. Select appropriate vehicle to conduct recovery.
    e. Forward a SITREP to higher headquarters once recovery is complete.
4. If organic assets are not capable of vehicle recovery, request external recovery support.
    a. Report location of vehicle.
    b. Report type of vehicle.
    c. Request specialized recovery support based on the disposition of the vehicle, its cargo, and the recommendations of the unit maintenance/recovery team.
    d. Coordinate route to the recovery site with higher headquarters.
    e. Coordinate security requirements with higher headquarters.
    f. Coordinate additional support as required (i.e., fire support, air support, firefighting support, environmental cleanup support, etc.)

Post-conditions: Vehicle recovered or destroyed.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis

1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

<table>
<tr><td colspan="3">Real World (RW) Preconditions:
IED or other event has occurred and rendered a vehicle or vehicles in need of recovery</td><td colspan="3">Environmental Evaluation</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of Support to Training</th></tr>
<tr><td>Visually inspect vehicle for damage</td><td><u>COGNITIVE:</u>
Oral Comprehension;
Oral Expression;
Deductive Reasoning;
Inductive Reasoning;
Problem Sensitivity;

<u>SENSORY:</u>
Night Vision;
Peripheral Vision;
Glare Sensitivity;
Depth Perception; Near Vision; Visual Color Discrimination; Speech Recognition; Speech Clarity; Hearing Sensitivity; Sound Localization;

<u>PSYCHOMOTOR:</u>
None

<u>PHYSICAL:</u>
None</td><td>– Damaged military vehicle
– Unit SOP for implementing recovery operation
– Knowledge of vehicle maintenance/ vehicle operation
– Urban or Suburban environment containing natural and manmade elements.
– Weather effects (i.e., heat, rain, dust, cold)</td><td><u>COGNITIVE:</u>
Problem Sensitivity;
Spatial Orientation;

<u>SENSORY:</u>
Near Vision; Visual Color Discrimination;

<u>PSYCHOMOTOR:</u>
Manual Dexterity;

<u>PHYSICAL:</u>
None</td><td>– Representation of damaged vehicle
– Unit SOP's assumed present and not expected from game
– Scenario environment represented
– Weather
– Representation of vehicle maintenance knowledge not present</td><td>5 – Excellent
*4 – Very Good
3 – Good
2 – Fair
1 – Poor

4 of 5 present</td></tr>
<tr><td>Physically inspect vehicle for damage

Cannot execute task</td><td><u>COGNITIVE:</u>
Oral Comprehension;
Oral Expression;
Deductive Reasoning;
Inductive Reasoning;
Problem Sensitivity;

<u>SENSORY:</u></td><td>– Damaged military vehicle
– Known standards (criteria) for recovery or destruction of unit equipment
– Unit SOP for implementing</td><td>*Cannot accomplish</td><td></td><td>5 – Excellent
4 – Very Good
3 – Good
2 – Fair
*1 – Poor</td></tr>
</table>

	Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Near Vision; Visual Color Discrimination; Speech Recognition; Speech Clarity; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** None **PHYSICAL:** None	recovery operation – Knowledge of vehicle maintenance/ vehicle operation – Urban or Suburban environment containing natural and manmade elements. – Weather effects (i.e., heat, rain, dust, cold)			
Forward the battle damage report to higher headquarters.	See coordinate activities with higher HQ	See coordinate activities with higher HQ	See coordinate activities with higher HQ	See coordinate activities with higher HQ	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor 3 tasks rated 5
Determine if the vehicle can be rapidly repaired through a physical inspection. **Cannot accomplish task**	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Number Facility; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Time	– Damaged vehicle that can be externally inspected – Damaged vehicle that can be internally inspected	*Cannot accomplish	– Game does not afford the ability to physically inspect damaged equipment	5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor

	Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; **PSYCHOMOTOR:** None **PHYSICAL:** Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium				
If vehicle cannot be rapidly repaired determine if the vehicle can be moved using available assets.	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Number Facility; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Time Sharing;	– Damaged vehicle that can be externally inspected – Damaged vehicle that can be internally inspected – Information/Knowledge of/about vehicle recovery capabilities	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Spatial Orientation; **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Multilimb Coordination; **PHYSICAL:** None	– Damaged vehicle only visually inspectable – Scaled knowledge of recovery operations represented via game menus	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor 2 of 3 present

	SENSORY: Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; **PSYCHOMOTOR:** None **PHYSICAL:** Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium				
Select recovery equipment and personnel in accordance with mission and capability.	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Originality; Problem Sensitivity; Number Facility; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity;	– Element recovery assets (e.g., M88, tow bar, Wrecker) – Knowledge of recovery requirements and operations – Personnel available to conduct recovery operations – Undamaged vehicles to assist in vehicle recovery	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Problem Sensitivity; Spatial Orientation; Memorization; **SENSORY:** Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition **PSYCHOMOTOR:** Manual Dexterity;	– Various recovery types of vehicles are supported in model menu – Game represents recovery procedures via AI and menu options that automatically conducts actions such as connecting towing cables – Personnel may be scripted or controlled by other human trainees – Unit equipment that	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor All Present

	Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; **PSYCHOMOTOR:** None **PHYSICAL:** Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium		**PHYSICAL:** None	can be used for recovery is represented	
Position recovery vehicle in position to tow damaged vehicle and connect damaged vehicle to recovery vehicle.	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Number Facility; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far	– Damaged vehicle – Organic recovery assets (e.g., M88, Wrecker, other vehicles, tow bars, tow cables) – Knowledge of recovery requirements and operations	**COGNITIVE:** Oral Expression; Oral Comprehension; Problem Sensitivity; Spatial Orientation; **SENSORY:** Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Multilimb Coordination; **PHYSICAL:** None	– Damaged vehicle – Organic and special recovery asset models available – Scaled representation of Knowledge to execute recovery operations present via AI or menu options	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor All Present

	Vision; Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; **PSYCHOMOTOR:** None **PHYSICAL:** Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium				
If organic assets are not capable of vehicle recovery, request external recovery support. a. Report location of vehicle. b. Report type of vehicle. c. Request specialized recovery support based on the disposition of the vehicle, its cargo, and the recommendations of the unit maintenance/recovery team. d. Coordinate route to	See coordinate activities with higher HQ	See coordinate activities with higher HQ	See coordinate activities with higher HQ	See coordinate activities with higher HQ	**The task of coordinating resources and information with higher headquarters has already been incorporated into this analysis and will not be scored here.

the recovery site with higher headquarters. e. Coordinate security requirements with higher headquarters. f. Coordinate additional support as required (i.e., fire support, air support, firefighting support, environmental cleanup support, etc.)					
Post-conditions: Vehicle recovered or destroyed					

SCORE: 2.33 Fair

High Level Task: Conduct CASEVAC Operations

Doctrine: ATP 4-25.13; Individual Task 081-833-0227 Coordinate Casualty Treatment and Evacuation

Preconditions: Initial first aid has been rendered to the casualty. MEDEVAC has been called. Casualty has been carried to a military vehicle that will carry him/her to the casualty collection point (CCP) for MEDEVAC or to the aid station.

NOTE CASEVAC refers to the movement of casualties aboard nonmedical vehicles or aircraft. Care is rendered while the casualty is awaiting pickup or is being transported. A Soldier accompanying an unconscious casualty should monitor the casualty's airway, breathing, and bleeding

Task:

1. Drive casualty to CCP.
2. Render buddy/first aid to casualty in route to CCP/aid station.
3. Monitor/maintain/control casualties airway and breathing and bleeding.

Post-conditions: Casualty moved to CCP/aid station.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Real World (RW) Preconditions: Initial first aid has been rendered to the casualty. MEDEVAC has been called. Casualty has been carried to a military vehicle that will carry him/her to the casualty collection point (CCP) for MEDEVAC or to the aid station.			**Environmental Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Drive casualty to CCP	**COGNITIVE:** Problem Sensitivity; Information Ordering; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; Hearing Sensitivity; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Control Precision; Response Orientation; Multilimb Coordination; Reaction Time; **PHYSICAL:**	– Urban or Suburban environment containing natural and manmade elements. – Weather effects (i.e., heat, rain, dust, cold) – Non-Medical military transport vehicles that contain the necessary controls for vehicular control and movement (e.g., steering mechanism, accelerator mechanism, brake mechanism) – Route of travel – Destination (i.e., CCP or aid station) – Potential and actual threats and obstacles – Driver	**COGNITIVE:** Spatial Orientation; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Multilimb Coordination; Reaction Time; **PHYSICAL:** Extent Flexibility;	– Steering wheel and pedals – Non-Standard Medical Vehicle represented in game environment – Physical environment represented in Game – Route of travel – Destination – Driver either AI or other human trainee	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Stamina; Extent Flexibility;				
Render buddy/first aid to casualty in route to CCP/aid station. **Cannot accomplish task**	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Response Orientation; Multilimb Coordination; Wrist-Finger Speed; Reaction Time; Speed of Limb	– Unit members who have received training in combat first aid – First Aid/Combat Lifesaver bag containing medical supplies – Casualty – Urban or Suburban environment containing natural and manmade elements. – Weather effects (i.e., heat, rain, dust, cold) – Coordinating communication between unit members – Non-medical vehicle	**Cannot accomplish		5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor

	Movement; **PHYSICAL:** Dynamic Strength; Stamina; Extent Flexibility				
Monitor/maintain/ control casualty's airway and breathing and bleeding. **Cannot accomplish Task**	**COGNITIVE:** Problem Sensitivity; Information Ordering; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Response Orientation; Multilimb Coordination; Wrist-Finger Speed; Reaction Time; Speed of Limb Movement; **PHYSICAL:** Dynamic Strength;	– Unit members who have received training in combat first aid – First Aid/Combat Lifesaver bag containing medical supplies – Casualty – Urban or Suburban environment containing natural and manmade elements. – Weather effects (i.e., heat, rain, dust, cold) – Non-medical military vehicle	**Cannot accomplish		5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor

	Stamina; Extent Flexibility				
Post-conditions: Casualty moved to CCP/aid station					

SCORE: 5.00 Excellent

High Level Task: Comply with rules of engagement (ROE)

Doctrine: STP 21-1-SMCT; FM 27-10 Law of land warfare; Individual Task 171-300-0083 Enforce Rules of Engagement (ROE); Individual task 71-300-0011 Employ progressive levels of force when confronting civilians; Individual task 181-105-1001 Comply with the Law of War and the Geneva and Hague Conventions

Preconditions: Soldier is provided with the rules of engagement (ROE) and escalation of force (EOF) guidelines.

Task: Comply with the rules of engagement (ROE)

Post-conditions: ROE/EOF observed and obeyed

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

<table>
<tr><td colspan="3">Real World (RW) Preconditions
ROE and SOPs are provided to SM and measures to check understanding have been executed</td><td colspan="3">Environmental Evaluation
Assessment of this task focused mainly on soldier understanding of the ROE based on Soldier actions and inactions as well as the environments ability to provide situations where the soldier is able to identify and determine items such as a hostile act, hostile intent, hostile force. Without specific ROE determining the human abilities necessary is problematic.</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of Support to Training</th></tr>
<tr><td>Comply with ROE</td><td><u>COGNITIVE:</u>
Oral Expression; Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning;; Problem Sensitivity; Information Ordering; Category Flexibility; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Selective Attention; Time Sharing;

<u>SENSORY:</u>
Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing</td><td>– ROE
– Events where Soldiers have to apply their understanding and interpretation of the ROE
– Enforcer of the ROE
– Punishment for violation of the ROE
– Standards for applying Escalation of Force (EOF)
– Unit SOPs for detainee operations and handling</td><td><u>COGNITIVE:</u>
Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing;

<u>SENSORY:</u>
Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Response Orientation; Rate Control; Reaction Time;

<u>PHYSICAL:</u>
None</td><td>– ROE assumed present and provided and is external of the game environment
– Standards for applying EOF assumed present
– Scenario editor allows for the development of scenarios that place trainees in situations where they must apply ROE appropriately
– Enforcement of ROE may be scripted into the scenario
– Punishment for violating ROE may be scripted into the scenario
– Unit SOP’s assumed present</td><td>*5 – Excellent
4 – Very Good
3 – Good
2 – Fair
1 – Poor

All present</td></tr>
</table>

	Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination; Wrist-Finger Speed; Reaction Time; Speed of Limb Movement; **PHYSICAL:** Static Strength; Explosive Strength Dynamic Strength; Trunk Strength; Stamina; Extent Flexibility; Dynamic Flexibility; Gross Body Coordination; Gross Body Equilibrium				
Post-conditions: Rules of engagement/ EOF are observed and obeyed					

SCORE: 5.00 Excellent

High Level Task: Scan my sector appropriately

Doctrine: STP 21-1-SMCT

Preconditions: SM informed of sector of responsibility for scanning; SM knowledgeable of appropriate search patterns

Task:

1. Confirm sector of assigned responsibility
2. Using optics and eyes: Observe an area of assigned responsibility for threats using an appropriate search pattern.

Post-conditions: Visual observation and scan for enemy threats is conducted to standard

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Real World (RW) Preconditions: Sector of responsibility for visual/optical/weapons scan is provided to the SM.			**Environmental Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Confirm sector of responsibility	**COGNITIVE:** Oral Expression; Oral Comprehension; Spatial Orientation; Flexibility of Closure; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Weather/Climate – Urban/Suburban environment with sprawl – Identifiable terrain or other features – Optics (Weapon, Vehicle, Personal) – A Means of communication with leader (FM/Digital communication device	**COGNITIVE:** Oral Expression; Oral Comprehension; Spatial Orientation; Flexibility of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** Finger Dexterity; Rate Control; Multilimb Coordination; Wrist-Finger Speed; **PHYSICAL:** None	– Scenario editor that allows for the building of scenarios containing weapons, optics, replication of weather/climate, terrain, enemy units, friendly units, vehicles; pedestrians etc. – Avatar with 1st person or 3rd person view wearing appropriate personal clothing and equipment – Headset to communicate with others – Keyboard control cheat sheet – Mouse	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor All present
Using optics/eyes: observe an area of assigned responsibility for threats using an appropriate search pattern	**COGNITIVE:** Spatial Orientation; Memorization; Selective Attention; Speed of closure; Flexibility of Closure **SENSORY:** Night Vision; Peripheral Vision;	– Area to observe – Potential threat activity	**COGNITIVE:** Spatial Orientation; Flexibility of Closure; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination;	– Keyboard control cheat sheet – Mouse – Keyboard – Scenario editor that allows for the building of scenarios containing weapons, optics, replication of weather/climate,	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor All present

	Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **<u>PSYCHOMOTOR:</u>** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **<u>PHYSICAL:</u>** Extent Flexibility;		**<u>PSYCHOMOTOR:</u>** Finger Dexterity; Response Orientation; Rate Control; Multilimb Coordination; Wrist-Finger Speed; Reaction Time; **<u>PHYSICAL:</u>** None	terrain, enemy units, friendly units, vehicles; pedestrians etc. – Avatar whose eyes the trainee views the environment	
Post-conditions: Observation and scan for enemy threats is conducted to standard					

SCORE: 3.67 Very Good

High Level Task: Communicate with members of your unit

Doctrine: FM 21-60 Visual Signals; Individual Task 171-170-0008 Submit reports using FBCB2; Individual Task 171-170-0001 Submit messages using FBCB2

Preconditions:

Task:

1. Transmit information to unit members verbally
2. Transmit information to unit members via digital systems
3. Transmit information to unit members via hand and arm signals

Post-conditions: Information is passed to unit members.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Real World (RW) Preconditions:			Environmental Evaluation		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Transmit and receive information verbally	**COGNITIVE:** Oral Expression; Oral Comprehension **SENSORY:** Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Audience to receive communication – Information to transmit – A way to send and receive verbal communications	**COGNITIVE:** Oral Expression; Oral Comprehension; **SENSORY:** Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Audience – Means to transmit via headset and simulated FM radio	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Transmit and receive information digitally Task not possible; No digital communication capability replicated	**COGNITIVE:** Oral Expression; Oral Comprehension; Written Comprehension; Written Expression; **SENSORY:** Near Vision; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Finger Dexterity; **PHYSICAL:**	– Audience to receive communication – Information to transmit – A way to send and receive digital communications	**Not supported**		5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor

	None				
Transmit and receive information using hand and arm signals or with other visual devices	**COGNITIVE:** Information Ordering; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Response Orientation; Multilimb Coordination; Wrist-Finger Speed; **PHYSICAL:** Extent Flexibility;	– Audience to receive communication with range to view hand and arm signals with naked eye – Information to transmit – Visual enhancement device (e.g., binoculars) – Visual signaling devices (e.g., Red, Green, Yellow flags, Colored flashlight lenses)	**COGNITIVE:** Information Ordering; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Response Orientation; **PHYSICAL:** None	– Audience – Information – Optics and visual enhancement devices replicated – Signaling via chemical lights and other means possible	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Post-conditions:					

SCORE: 5.00 Excellent

High Level Task: Coordinate activities with your chain of command (CoC)

Doctrine: Task Number: 34-2-0010 Task Title: Report Tactical Information

Preconditions:

Task:

1. The element observes threat or other activities that are reportable in accordance with the TACSOP.
2. The element reports to their immediate element leader a description of the activities observed.
3. The element leader reports to higher headquarters using SALUTE via tactical FM radio or other tactical means.
    a. Size: Express as a quantity or Echelon
    b. Activity: What is happening should be a concise bullet statement.
    c. Location: An 8 or 10 digit grid coordinate, or an address, if appropriate.
    d. Unit: Who is performing the activity? Designate the unit or identify a group or individual.
    e. Time: When the activity was observed, or if ongoing when it was initiated.
    f. Equipment: Describe/identify any equipment
    g. Remarks: Identify any other pertinent/time sensitive information that must be passed.

Post-conditions: Activities of unit are known to CoC.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Real World (RW) Preconditions:			Environmental Evaluation		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
The element observes threat or other activities that are reportable in accordance with the TACSOP	**COGNITIVE:** Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Speed of Closure; Problem Sensitivity; Information Ordering; Number Facility; Spatial Orientation; Flexibility of Closure; Perceptual Speed; Memorization; Time Sharing; Selective Attention **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Speech Recognition; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; Wrist-	– Urban or Suburban environment containing natural and manmade elements – Weather /climate effects (i.e., heat, rain, dust, cold) – Personal protective equipment and weapons (i.e., helmet, IBAS, LBE, M4) – Ammunition (personal weapon and crew served) – Crew served weapons – Appropriate military vehicles with mounted crew served weapons – Chain of Command – Observable threat or indicator of possible threat – A way to determine direction and distance (compass, GPS, Weapon sight, laser range finder, binoculars etc) – Night vision devices – ROE	**COGNITIVE:** Problem Sensitivity; Spatial Orientation; Flexibility of Closure; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Rate Control; **PHYSICAL:** None	– All present – Assumed that ROE is provided externally to the game	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Finger Speed; **PHYSICAL:** Extent Flexibility	– Other unit members			
The element reports to their immediate element leader a description of the activities observed.	**COGNITIVE:** Oral Expression; Oral Comprehension; Problem Sensitivity; Information Ordering; Number Facility; Spatial Orientation; Memorization **SENSORY:** Speech Clarity; Speech Recognition; Hearing Sensitivity **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; **PHYSICAL:** Extent Flexibility;	– FM/Digital Communication equipment – Communications link with other elements of unit/leader – Reporting SOP – Report Format	**COGNITIVE:** Oral Expression; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity **PHYSICAL:** None	– 4 radio nets represented in game – FM capability represented no digital – Reporting SOP and Format external to game – Headsets for communications	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
The element leader reports to higher headquarters using SALUTE via tactical FM radio or other tactical means. a. Size: Express as a quantity or Echelon b. Activity: What is happening should be a concise bullet	**COGNITIVE:** Oral Expression; Written Comprehension; Problem Sensitivity; Information Ordering; Number Facility; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing;	– FM/Digital Communication equipment – Communications link with other elements of unit/leader – Reporting SOP – Report Format – Information about: – -Enemy element size – -Enemy Activity – -Location of threat	**COGNITIVE:** Oral Expression; Written Comprehension; Problem Sensitivity; Information Ordering; Number Facility; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Memorization; Time Sharing	– 4 radio nets represented in game – FM capability represented no digital – Reporting SOP and Format external to game – Headsets for communications	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

statement. c. Location: An 8 or 10 digit grid coordinate, or an address, if appropriate. d. Unit: Who is performing the activity? Designate the Unit or identify a group or individual. e. Time: When the activity was observed, or if ongoing when it was initiated. f. Equipment: Describe/Identify any equipment g. Remarks: Identify any other pertinent/time sensitive information that must be passed.	**SENSORY:** Night Vision; Near Vision; Speech Clarity; Hearing Sensitivity; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; **PHYSICAL:** Extent Flexibility	– -Own Unit designation – -Time of contact – -Enemy equipment – -Any additional information about situation that the leader wants to add or is required per SOP – Chain of command	**SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; **PHYSICAL:** None		
Post-conditions:					

APPENDIX E. ANALYSIS OF FSC

The following pages provide the first analysis of the FSC action items using ITEAM. This analysis used the original five-point rating scale for scoring.

Action Item: Analyze the Enemy Situation **Very Good 3.66**

Doctrine: FM 3-21.8, 3-21.10, 5-0

Preconditions: Trainee has knowledge of enemy doctrine and weapons capabilities; Trainee receives information from his higher headquarters including an enemy situational template (SITTEMP), current intelligence assumptions regarding enemy capabilities (i.e., composition, disposition, strength and recent activities); Trainee has conducted an analysis of the terrain and weather conditions within the area of interest and area of operations.

Task: Analyze the Enemy Situation

1. Trainee processes all provided information about the enemy capabilities with his own knowledge of and experience with the threat.
2. Trainee reviews the current enemy situational template depicting the disposition of forces
3. Trainee considers the enemy intelligence information in conjunction with the terrain and weather data provided
4. Trainee repeats steps 1–3 as new information becomes available.

Post-conditions: Trainee has understanding of current enemy situation; Trainee has insight into possible future enemy courses of action

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis

<u>1–Poor</u> – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Comments:

Several FSC scenarios provide the trainee with information about the threat but no enemy situational templates are provided as part of the game. The games scenario editor allows for as much or as little information about the enemy to be included in the Battalion Operations orders, which we believe negates the absence of the situational template. The game contains the ability to add or delete map data as desired.

FSC supports the training of this action item. Overall rating: Very Good 3.66

Real World (RW) Preconditions: Trainee has knowledge of enemy doctrine and weapons capabilities; Trainee receives information from his higher headquarters including an enemy situational template (SITTEMP), current intelligence assumptions regarding enemy capabilities (i.e., composition, disposition, strength and recent activities); Trainee receives current information about weather and terrain conditions within the area of interest and area of operations			**Environment Evaluation** Enemy situational template is not provided by the system.		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Trainee processes the information provided to him about the enemy with his own knowledge of and experience with the threat	**<u>COGNITIVE:</u>** Oral comprehension; Written comprehension; Inductive Reasoning; Problem Sensitivity; Spatial Orientation; Speed of Closure; Memorization **<u>SENSORY:</u>** Near Vision **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** None	– Composition and strength of enemy force – Enemy most likely course of action – Enemy weapons capabilities – Current and probable locations of enemy forces – Recent enemy activity in the area – Any tools necessary to annotate, arrange or depict information for analysis (e.g., acetate, map, alcohol pens, written order, paper, pencil, mission command systems)	**<u>COGNITIVE:</u>** Oral comprehension; Written comprehension; Inductive Reasoning; Problem Sensitivity; Speed of Closure; Memorization **<u>SENSORY:</u>** Near Vision **<u>PSYCHOMOTOR:</u>** Manual Dexterity, Finger Dexterity **<u>PHYSICAL:</u>** None	– Scenario editor allows for enemy information to be included as part of the operations order	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee reviews the enemy situational template	**<u>COGNITIVE:</u>** Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity	– Enemy Situational Template – Map of operational area with appropriate graphics and symbols represented	**<u>COGNITIVE:</u>** Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity	– Enemy Situational template not provided	5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor

	SENSORY: Near vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Any mission command systems that are used to assist in organizing or analyzing enemy information – See perform terrain analysis	**SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None		
Trainee considers enemy information in conjunction with terrain and weather data	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Speed of Closure; Memorization **SENSORY:** None **PSYCHOMOTOR:** None **PHYSICAL:** None	– Light and weather data – Information about terrain and weather from previous analysis. (See perform terrain analysis) – Enemy information from step 1 (i.e., disposition, composition, suspected locations, likely actions)	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Speed of Closure; Memorization **SENSORY:** None **PSYCHOMOTOR:** None **PHYSICAL:** None	– Scenario editor allows for the inclusion of Terrain and Weather data as part of the battalion operations order.	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Post-conditions: Trainee has understanding of current enemy situation; Trainee has insight into possible future enemy courses of action					

Score: Very Good 4.00

Action Item: Perform Terrain Analysis

Doctrine: FM 5-0, 3-21.10

Preconditions: Trainee has been issued a mission order and understands his AO and AI; Trainee is familiar with troop leading procedures, mission analysis and METT-TC; Trainee has conducted steps 1 and 2 of the troop leading procedures

Task: Conduct a terrain analysis from a map and materials provided by the higher headquarters using the acronym OAKOC (Obstacles, Avenues of Approach, Key Terrain, Observation and Fields of Fire, Cover and Concealment).

Post-conditions: Terrain Analysis answers the question: What is the terrain's effect on the operation?; Graphical Display of the Terrain (GDOT) produced

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Results:

FSC's scenario development tool allows for as much or as little information to be provided to the trainee in the form of the operations order. There is no maneuver combined obstacle overlay functionality provided in the game. The lack of a MCOO does not prohibit the Battalion operations order from providing as much detail as necessary to support training this task. FSC does provide several map and simulated picture views of the natural and urban terrain for trainees to use during mission planning.

FSC supports the training of this action item. Overall rating: **Very Good**

Real World (RW) Preconditions: Trainee has been issued a mission order and understands his AO and AI; Trainee is familiar with troop leading procedures, mission analysis and METT-TC; Trainee has conducted steps 1 and 2 of the troop leading procedures			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Conduct a terrain analysis from a map and materials provided by the higher headquarters using the acronym OAKOC (Obstacles, Avenues of Approach, Key Terrain, Observation and Fields of Fire, Cover and Concealment).	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Memorization **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Paragraph 1 of OPORD that provides information from higher headquarters about the terrain and weather. – Maneuver Combined Obstacle Overlay from higher headquarters – Representation of the terrain that the trainee will maneuver over (e.g., map, aerial photographs) – Intelligence information about enemy emplaced, natural or man-made obstacles known by the higher headquarters	**COGNITIVE:** **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor allows for as much or as little detail as desired in paragraph 1 of the OPORD. – Scenario editor allows maps and simulated photography to be provided in the scenario. – No MCOO functionality exists in the game	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee repeats analysis as necessary to maintain a current assessment					
Post-conditions: Answer provided to question: What is the terrain’s effect on the operation?; Graphical Terrain Analysis Overlay (GTAO) developed					

Score: Good 3.00

Action Item: Conduct an AAR

Doctrine: TC 25-20; AR 11-13

Preconditions: Mission or exercise has concluded or been stopped; Type/Format of AAR decided.

Task: Conduct an AAR

Post-conditions: Trainee has a better understanding of events and how his actions influenced mission outcomes.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Comments:

The game provides the necessary information for the conduct of an AAR but does not address the requirement of a facilitator, training objectives and doctrinal references. If these are supplied as part of the POI then AARs are fully supported.

FSC supports this action item. Overall Rating: **Good**

<table>
<tr><td colspan="3">Real World (RW) Preconditions:
Mission or exercise has concluded or been stopped; Type/Format of AAR decided</td><td colspan="3">Environment Evaluation</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of support to training</th></tr>
<tr>
<td>Conduct an AAR:

1. During or immediately after each event
2. Focus on intended training objectives
3. Focus on soldier, leader and unit performance
4. Involve all participants in the discussion.
5. Use open-ended questions.
6. Are related to specific standards.
7. Determine strengths and weaknesses.
8. Link performance to subsequent training.</td>
<td><u>COGNITIVE:</u>
Oral Expression; Oral Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure; Perceptual Speed

<u>SENSORY:</u>
Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition;

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity; Reaction Time;

<u>PHYSICAL:</u> Stamina; Gross Body Equilibrium</td>
<td>– A way to identify, recreate or represent significant events that occurred during training
– Representation or replication of trainee performance at identified key points in training
– A Facilitator
– Training Audience
– Training Objectives
– Doctrinal references/info</td>
<td><u>COGNITIVE:</u>
Inductive Reasoning; Problem Sensitivity; Information Ordering; Speed of Closure; Perceptual Speed

<u>SENSORY:</u>
Near Vision; Visual Color Discrimination;

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity;

<u>PHYSICAL:</u>
None</td>
<td>– Recording of mission
– Statistics dealing with weapon use (e.g., mortars, grenade, satchel charges and javelins)
– Weapon distributions and ammo expenditure
– Casualties
– Blue force plan OPORD
– Red force plan
– Review screen that allows players to view operation and stop at decision points to view specific events
– Explainable AI that allows preformatted questions to be asked of Soldiers to determine what was going on at that time.</td>
<td>5 – Excellent
4 – Very Good
*3 – Good
2 – Fair
1 – Poor</td>
</tr>
<tr><td colspan="6">Post-conditions:
Trainee has a better understanding of events and how his actions influenced mission outcomes.</td></tr>
</table>

Score: Good 3.45

Action Item(s):
Synchronize a light company team attack in an urban operation
Synchronize the engineer portion of a light infantry company attack
Synchronize the indirect fires portion of a light infantry company attack

Doctrine: FM 3-21.10

Preconditions: Trainee has received a mission order; Trainee has knowledge of doctrine dealing with offensive and urban operations; Trainee has knowledge about how to plan indirect fires and breaching operations.

Task (s):

1. Integrate the following to develop a course of action:

    Apply selected steps of the Troop Leading Procedures (Partially Evaluated)
    Conduct Mission Analysis (Partially evaluated)
    Analyze civil considerations (Evaluated)
    Analyze enemy situation (Evaluated)
    Perform terrain analysis (Evaluated)
    Develop a course of action for a light infantry company (Evaluated)
    Conduct Reconnaissance (Evaluated)
    Determine own force potential (Evaluated)
    Integrate the fundamentals of the offense into a COA (Evaluated)
    Integrate fire support into urban operations (Evaluated)
    Plan breaching operations (Evaluated)
    Select a COA (Evaluated)
    Issue a FRAGO (Evaluated)

2. Command and control the execution of the plan.

Post-conditions: Plan is developed and actions are synchronized; Plan is executed and adjustments are made based on changing battlefield conditions

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Results:

FSC enables a trainee to think through and develop a plan for several operational scenarios. As a part of the planning process trainees are required to execute the cognitive actions required to synchronize plans for success. During the execution of the plans developed, trainees must react to unplanned/unforeseen situations and synchronize the effects of several combat multipliers. While the actions of command and control are limited FSC does afford a trainee the opportunity to practice synchronization actions.

FSC supports the training of this action item. Overall rating: **Good**

Real World (RW) Preconditions: Trainee has received a mission order; Trainee has knowledge of doctrine dealing with offensive and urban operations; Trainee has knowledge about how to plan indirect fires and breaching operations			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Apply selected troop leading procedures	See apply selected troop leading procedures	See apply selected troop leading procedures	See apply selected troop leading procedures	See apply selected troop leading procedures	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Conduct Mission Analysis	See conduct mission analysis	See conduct mission analysis	See conduct mission analysis	See conduct mission analysis	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Analyze civil considerations	See analyze civil considerations	See analyze civil considerations	See analyze civil considerations	See analyze civil considerations	5 – Excellent 4 – Very Good 3 – Good *2 – Fair 1 – Poor
Analyze enemy situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Perform terrain analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Develop a course of action for a light infantry company	See develop a light infantry company course of action	See develop a light infantry company course of action	See develop a light infantry company course of action	See develop a light infantry company course of action	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Conduct	See conduct	See conduct	See conduct	See conduct	5 – Excellent

Reconnaissance	reconnaissance	reconnaissance	reconnaissance	reconnaissance	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Determine own force potential	See determine own force potential combat power	See determine own force potential combat power	See determine own force potential combat power	See determine own force potential combat power	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Integrate the fundamentals of the offense into a COA	See integrate the fundamentals of the offense into a COA	See integrate the fundamentals of the offense into a COA	See integrate the fundamentals of the offense into a COA	See integrate the fundamentals of the offense into a COA	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Integrate fire support into urban operations	See integrate fire support into urban operations	See integrate fire support into urban operations	See integrate fire support into urban operations	See integrate fire support into urban operations	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Plan breaching operations	See plan breaching operations	See plan breaching operations	See plan breaching operations	See plan breaching operations	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Select a COA	See select a course of action	See select a course of action	See select a course of action	See select a course of action	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Issue a FRAGO	See issue a FRAGO	See issue a FRAGO	See issue a FRAGO	See issue a FRAGO	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Command and Control Execution (Supervise)	**<u>COGNITIVE:</u>** Oral Expression; Oral Comprehension;	– Elements to command and a tactical scenario in which to control	**<u>COGNITIVE:</u>** Oral Comprehension; Written	– AI Unit – Higher HQ	*5 – Excellent 4 – Very Good 3 – Good

	Written Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Selective Attention; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control;	them. – Scenario providing representations of the higher commander, the enemy, the physical environment and the enemy. – The environment should afford radio communications between the trainee, his unit elements and his higher headquarters. – The environment should afford interaction between the trainee, his subordinate elements, his higher headquarters and the enemy. – Environment should afford the trainee a way to adjust his plan and issue new orders during the scenario as in real life.	Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Game acts as mission command system during execution – Tactical scenario – Interaction through scripted messages, simulated radio traffic and FRAGO orders – FRAGO capability	2 – Fair 1 – Poor

	Multilimb Coordination; **<u>PHYSICAL:</u>** Explosive Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium				
Post-conditions: Plan is developed and actions are synchronized; Plan is executed and adjustments are made based on changing battlefield conditions					

Score: Excellent 5.00

Action Item: Determine own force potential combat power

Doctrine: FM 3-21.10

Preconditions: Trainees receive a mission order and a task organization for execution of the mission for their unit.

Task: Determine force combat power: Identify all available organic and non-organic unit assets available to determine the unit's strength, composition and capabilities.

Post-conditions: Trainees have an understanding of the composition, strength and capabilities of all assets available to them for their assigned mission.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Comments:

The scenario-editing tool allows the trainer to increase or decrease the amount of detail provided to the trainee as part of the operations order process. The trainee is not able to ascertain the strengths and weaknesses of unit personnel or weapons systems. FSC provides information about task organization, composition and available assets of unit elements. While it is possible to specify the percentage of capability of a unit, an assumption that is made is that the unit is 100percent capable given the task organization present and that any augmentation of the unit is provided at 100percent of its capability as well.

FSC supports this action item. Overall rating: **Excellent**

<table>
<tr><td colspan="3">Real World (RW) Preconditions:
Trainee receives a mission order and a task organization for execution of the mission for his unit.</td><td colspan="3">Environmental Evaluation</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of support to training</th></tr>
<tr><td>Trainees identify all available organic and non-organic assets available to them to determine their unit’s strength, composition and capabilities.</td><td><u>COGNITIVE:</u>
Written Comprehension; Oral Comprehension; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Visualization; Perceptual Speed; Memorization;

<u>SENSORY:</u>
Near Vision; Speech Recognition

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity;

<u>PHYSICAL:</u>
None</td><td>– Information about available assets for the trainee to use to accomplish his mission.
– Information about strengths and weaknesses of unit equipment and personnel.
– Friendly weapons capabilities, status and number
– Tools that assist the trainee in annotating, arranging or depicting own unit information for analysis (e.g., acetate, map, alcohol pens, written order, paper, pencil, computer screens)</td><td><u>COGNITIVE:</u>
Written Comprehension; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Memorization;

<u>SENSORY:</u>
Near Vision;

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity;

<u>PHYSICAL:</u>
None</td><td>– Task organization for trainee’s unit
– Notification of additional assets provided to support trainee
– Scenario editor that allows the trainer to increase or decrease the amount of information about the unit or attachments depending on the intent of the training.</td><td>*5 – Excellent
4 – Very Good
3 – Good
2 – Fair
1 – Poor</td></tr>
<tr><td colspan="6">Post-conditions:
Trainee has an understanding of the composition, strength and capabilities of all assets available to him for his assigned mission.</td></tr>
</table>

Score: GOOD 3.00

Action Item: Select a Course of Action (COA)

Doctrine: FM 3-21.10, 5-0

Preconditions: Trainee is familiar with the troop leading procedures; Trainee is familiar with the execution of mission analysis and course of action development; Trainee has developed at least 2 courses of action; All courses of action have been evaluated for their suitability, completeness, feasibility, distinctness and completeness.

Task: Select a COA that meets the requirements of the battalion commander's intent, achieves the company's purpose, maximizes the effects of terrain, minimizes casualties, and is within the company's capabilities.

Post-conditions: Best COA is selected from available alternatives that satisfies the need and operational conditions

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

**Note: FM 3-21.10 states that at the company level only one COA is usually generated. At higher levels more that one course of action is developed and compared making the selection process a more formal one.

Evaluation Results:

FSC does not have the ability to develop multiple courses of action for possible employment and further FSC does not separate COA development from OPORD development. As noted above, doctrine accepts the generation and implementation of only one COA as part of the mission analysis process at the company level. While we believe that the merging of COA development and OPORD development does not result in negative training, it violates doctrinal guidance concerning the development, wargaming and selection of a COA.

FSC does not support the training of this action item. Overall Rating: **Good**

<table>
<tr><td colspan="3">Real World (RW) Preconditions: Trainee is familiar with the troop leading procedures; Trainee is familiar with the execution of mission analysis and course of action development; Trainee has developed at least 2 courses of action; All courses of action have been evaluated for their suitability, completeness, feasibility, distinctness and completeness</td><td colspan="3">Environment Evaluation
System allows for the development of only 1 COA that is the operations order that is issued to the unit.</td></tr>
<tr><th>Tasks</th><th>Human Abilities</th><th>Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of Support to training</th></tr>
<tr><td>Select a course of action</td><td><u>COGNITIVE:</u>
Deductive Reasoning; Problem Sensitivity

<u>SENSORY:</u>
Near Vision

<u>PSYCHOMOTOR:</u>
None

<u>PHYSICAL:</u>
None</td><td>– A course of action that has been developed.
– A means to physically select or annotate selection of one COA</td><td><u>COGNITIVE:</u>
Deductive Reasoning; Problem Sensitivity

<u>SENSORY:</u>
Near Vision

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity

<u>PHYSICAL:</u>
None</td><td>– The ability to develop an operations order that contains a course of action that is issued to the unit for execution.</td><td>5 – Excellent
4 – Very Good
*3 – Good
2 – Fair
1 – Poor

**This item should be rated as Poor because the system does not allow the development and selection of a COA separate from the development of the operations order.</td></tr>
<tr><td colspan="6">Post-conditions: Best COA is selected from available alternatives that satisfies the need and operational conditions</td></tr>
</table>

Score: Good 3.25

Action Item: Apply Selected Troop Leading Procedures

Doctrine: FM 3-21.10, 5-0

Preconditions: Headquarters has issued a mission type order.

Tasks:

1. Receive the mission and conduct analysis of its contents
2. Issue a warning order to unit to allow them to begin parallel planning
3. Make a tentative Plan that will be the basis for the OPORD
4. Initiate movement of unit elements so that they may be prepared for initiation of the mission
5. Reconnoiter in support of plan development
6. Complete the plan and develop the OPORD
7. Issue OPORD
8. Supervise execution of OPORD

Post-conditions: Trainee understands higher commanders mission and intent; Trainee understands the threat and higher commanders CCIR; Trainee develops a plan for his unit that has taken account of specified, implied and critical tasks necessary to fulfill the higher headquarters mission; Trainee issues his mission order to his unit elements and controls it's execution; Trainee exercises command.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Comments:

Each scenario within FSC initially provides the trainee with a BN mission using the 5-paragraph format. FSC does not allow the trainee to develop or issue warning orders. Initiation mission time prior to order issuance is possible but only allows the opposing force to initiate movement prior to order execution. The ability to conduct reconnaissance is limited to map reconnaissance using the provided map and imagery that exists as part of the scenario. Trainee developed operations orders are matrix style graphical templates not the standard 5-paragraph field order. The actions of making a tentative plan and completing the plan are executed as one step when the trainee puts together his operations order for the mission. Supervision is conducted by monitoring the activities of forces via radio and visual means as an avatar on the field of battle.

The analysis of this action item supports the assertion that applying *select* troop leading procedures is possible.

FSC supports training this action item. Overall rating: **Good**

Real World (RW) Preconditions: Higher Headquarters has issued a mission type order			**Environment Evaluation**		
Tasks	**Human Abilities**	**Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Receive the mission and conduct analysis of its contents	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Visualization; Spatial Orientation; Selective Attention; Time Sharing; **SENSORY:** Near Vision; Auditory Attention **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Higher headquarters mission and commanders intent – See assess enemy situation – See perform terrain analysis – See determine own force potential combat power – A means to develop a timeline and keep track of time available for planning	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Visualization; Spatial Orientation **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– System scenario development tool allows for as much or as little information about the mission to be provided to the trainee. – System provides the option of changing the amount of available time to complete the mission but does not have a timeline tool or representation	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Issue a warning order to unit to allow them to begin parallel planning	**COGNITIVE:** Oral Expression; Written Expression; **SENSORY:** Near Vision; Speech Clarity; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity;	– Audience to issue order too – Ability to develop a warning order – Warning order format – A means of transferring the information to the audience if other than verbally (e.g., mission command system).	**COGNITIVE:** None **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Audience of artificially intelligent avatars that execute instructions – A way to transmit the order – No warning order functionality present in the game.	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor **This item would be rated as Poor if tasks were not considered equally important. Not having a warning order to issue makes this task

	PHYSICAL: None				untrainable.
Make a tentative Plan that will be the basis for the OPORD	**COGNITIVE:** Written Comprehension; Written Expression; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Number Facility; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Selective Attention; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See develop a light infantry COA – See conduct mission analysis	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See develop a light infantry COA – See conduct mission analysis	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Initiate movement of unit elements so that they may be prepared the mission	**COGNITIVE:** Oral Expression; Written Expression; Problem Sensitivity; Spatial Orientation; **SENSORY:** Speech Clarity;	– Environment must provide the trainee the ability to initiate movement of his forces in preparation for plan execution prior to OPORD issuance (e.g., move	**COGNITIVE:** Written Expression; Problem Sensitivity; **SENSORY:** Near Vision **PSYCHOMOTOR:**	– Settings within the scenario allow the opposing force to move during planning but not friendly forces – No WARNO capability – Game acts as mission	5 – Excellent 4 – Very Good 3 – Good *2 – Fair 1 – Poor

	PSYCHOMOTOR: Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; **PHYSICAL:** Dynamic Strength; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	vehicles to staging point, conduct reconnaissance, conduct rehearsals) – Ability to develop Warning type orders – A means to transmit orders (e.g., mission command system, radio)	Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	command system	
Reconnoiter in support of plan development	– See Conduct Reconnaissance	– See Conduct Reconnaissance	– See Conduct Reconnaissance	– See Conduct Reconnaissance	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Complete the plan and develop the OPORD	**COGNITIVE:** Oral Comprehension; Written Expression; Deductive Reasoning; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Selective Attention; Time Sharing; **SENSORY:** Near Vision; Auditory Attention; Speech Recognition;	– See assess civil considerations – Outputs or pieces of necessary information from previous steps of the mission analysis and troop leading processes – Pieces of the operations order or plan that are to be combined together to make up the plan of action	**COGNITIVE:** Written Expression; Deductive Reasoning; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See assess civil considerations – Higher HQ OPORD and intelligence information	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor

	PSYCHOMOTOR: Manual Dexterity; Finger Dexterity; **PHYSICAL:** None				
Issue OPORD	**COGNITIVE:** Oral Expression; Written Expression; **SENSORY:** Near Vision; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See issue infantry company or company-team operations order	**COGNITIVE:** Written Expression **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See issue infantry company or company-team operations order	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Supervise execution of the OPORD	**COGNITIVE:** Oral Expression; Oral Comprehension; Written Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Selective Attention;	– Elements to command and a tactical scenario in which to control them. – Any mission command systems available and normally used in the act of commanding or controlling a tactical plan – Scenario providing representations of the higher commander, the enemy, the physical environment and the enemy.	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination	– AI Unit – Higher HQ – Game acts as mission command system during execution – Tactical scenario – Interaction through scripted messages, simulated radio traffic and FRAGO orders – FRAGO capability	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Time Sharing; **<u>SENSORY:</u>** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **<u>PSYCHOMOTOR:</u>** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination; **<u>PHYSICAL:</u>** Explosive Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	– The environment should provide a way for the trainee to interact with his subordinate elements, his higher headquarters and the enemy (i.e., communicate, signal, attack, etc.) – Environment should provide a means for the trainee a way to adjust his plan and issue new orders during the scenario as in real life (See issue a FRAGO)	**<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None		
Post-conditions: Trainee understands higher commanders mission and intent; Trainee understands the threat and higher commanders CCIR; Trainee develops a plan for his unit that has taken account of specified, implied and critical tasks necessary to fulfill the higher headquarters mission; Trainee issues his mission order to his unit elements and controls it’s execution; Trainee exercises command					

Score: Fair 2.00

Action Item: Assess Civil Considerations

Doctrine: FM 3-24, 3-34, 5-0

Preconditions:

1. Trainee is familiar with doctrinal description of assessment (FM 5-0)
   - Gather tools and assessment data.
   - Understand current and desired conditions.
   - Develop assessment measures and potential indicators.
   - Develop the collection plan.
   - Assign responsibilities for conducting analysis and generating recommendations.
   - Identify feedback mechanisms.
2. Trainee has knowledge and understanding about civil considerations: The influence of manmade infrastructure, civilian institutions, and attitudes and activities of the civilian leaders, populations, and organizations within an AO on the conduct of military operations (FM 6-0).
3. Trainee receives current information regarding important civil considerations in his area of operations.

Tasks:

1. Trainee develops or adopts an existing assessment mechanism to categorize civil considerations (e.g., SWEAT [sewage, water, electricity, academics, trash] or ASCOPE [areas, structures, capabilities, organizations, people, events])
2. Trainee gathers and processes all available information about the civil considerations in his AO.
3. Trainee assigns a quantitative or qualitative value to each piece of the assessment mechanism based on 1.
4. Trainee monitors status of the conditions on the ground and updates his assessment (repeat steps 1-3) as necessary.

Post-conditions: Trainee is familiar with the important civil considerations within his AO; Trainee has increased proficiency in assessing the impact of civil considerations on military operations.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Comments:

No information about the civilian population relevant to civil considerations was provided in any of the scenarios provided with the game. The scenario editor allows for information to be added into the BN OPORD as necessary. The game itself acts as a default mission command (MC) system but does not contain any way for the trainee to build an assessment mechanism. The game does not include any structured or preformatted assessment mechanism for trainee use.

FSC supports training this action item. Overall Rating: **Fair**

Real World (RW) Preconditions: Trainee is familiar with doctrinal description of assessment (FM 5-0); Trainee has knowledge and understanding about civil considerations; Trainee receives current information regarding important civil considerations in his AO.			**Environment Evaluation** No information concerning civil considerations within the AO is provided to the Trainee by the game or the scenarios violating this necessary precondition.		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Trainee develops or adopts an existing assessment mechanism to categorize civil considerations.	**COGNITIVE:** Written Expression; Oral Expression; Fluency of Ideas; Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity; Originality; Category Flexibility; Memorization **SENSORY:** Near vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Example assessment mechanism – Tools to develop an assessment mechanism (e.g., mission command systems, pens, paper, etc.) – Way to visualize assessment	**COGNITIVE:** Fluency of Ideas; Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity; Originality; Category Flexibility; Memorization **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– None	5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor
Trainee gathers and processes all available information about the civil considerations in his AO.	**COGNITIVE:** Oral comprehension; Written comprehension; Inductive Reasoning; Problem Sensitivity; Information Ordering; Speed of Closure **SENSORY:** Near Vision	– Information about the civilian population, government and urban landscape. – Known friction points between civilian population and friendly forces – Known problems within the civilian	**COGNITIVE:** Written Comprehension; Inductive reasoning; Problem Sensitivity **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity;	– Scenario editor provides the ability to have as much or as little information about the population as desired. This information would come from the BN OPORD. – System does not provide any way to	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	PSYCHOMOTOR: Manual Dexterity; Finger Dexterity **PHYSICAL:** None	population (e.g., fighting over oil rights) – Tools to annotate, arrange or depict information for analysis (e.g., mission command systems, acetate, map, alcohol pens, written order, paper, pencil, computer screens)	Finger Dexterity **PHYSICAL:** None	develop or annotate an assessment mechanism	
Trainee assigns a quantitative or qualitative value to each piece of the assessment mechanism based on 1.	**COGNITIVE:** Mathematical Reasoning; Number Facility; Inductive Reasoning; Deductive Reasoning **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Tools to mark or annotate the assessment mechanism – Assessment mechanism – Way to visualize the assessment mechanism (e.g., mission command system)	**COGNITIVE:** None **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– None	5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor
Trainee monitors status of the conditions on the ground and updates his assessment (repeat steps 1-3) as necessary.	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Speed of Closure; Memorization;	– Information about civil conditions in the area of operations that stimulate the use of an assessment mechanism or impact ongoing operations that the trainee must react to.	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Speed of Closure; Memorization	– None	5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor

	SENSORY: Peripheral Vision; Depth Perception; Far Vision; Near Vision; Speech Recognition; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Mission command system if used and available	**SENSORY:** Near Vision **PSYCHOMOTOR:** None **PHYSICAL:** None		
Post-conditions: Trainee is familiar with the important civil considerations within his AO; Trainee has increased proficiency in assessing the impact of civil considerations on military operations.					

Score: Good 3.28

Action Item: Integrate fundamentals and techniques of the offense into a COA

Doctrine: FM 3-21.10, 5-0

Preconditions: Trainee has understands the fundamentals of offensive operations (Surprise, Concentration, Audacity, Tempo, Flexibility); Trainee has been issued a mission order that directs his element to conduct an offensive operation; Trainee is familiar with the techniques of offensive operations (Movement to Contact, Attack, Exploitation, Pursuit)

Task: Develop an offensive COA

1. Identify the necessary offensive technique for the specified mission (Movement to Contact, Attack, Exploitation, Pursuit)
2. Analyze relative combat power (strengths and weaknesses)
3. Generate options that incorporate the fundamentals of offensive operations and offensive technique
4. Array the forces available
5. Develop an offensive concept of the operation
6. Assign responsibilities
7. Prepare a COA statement and sketch

Post-conditions: COA is developed that incorporates the fundamentals of the offense appropriately and meets the criteria of being suitable, acceptable, feasible, distinguishable and complete.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Results:

FSC contains several offensive scenarios and tools that facilitate the development and execution of offensive plans. Only one order may be generated at a time unless the trainee develops other COAs outside of the game.

FSC supports training this action item. Overall rating: **Good**

Real World (RW) Preconditions: Trainee has understands the fundamentals of offensive operations (Surprise, Concentration, Audacity, Tempo, Flexibility); Trainee is familiar with the techniques of offensive operations (Movement to Contact, Attack, Exploitation, Pursuit); Trainee has been issued a mission order that directs his element to conduct an offensive operation.			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Limit of Support to Training**
Identify the necessary offensive technique for the specified mission	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Speed of Closure; Memorization; **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Operations order from the higher headquarters that informs the trainee about the higher headquarters mission and what tasks his unit is responsible for. – See analyze enemy situation – See perform terrain analysis – See conduct mission analysis	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Speed of Closure **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Higher HQ OPORD – See assess enemy situation – See perform terrain analysis – See conduct mission analysis	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Analyze own relative combat power (strengths, weaknesses)	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Visualization; Speed of Closure;	– See determine own force potential combat power	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Visualization; Speed of Closure;	– See determine own force potential combat power	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	SENSORY: Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		**SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Generate options that incorporate the fundamentals of offensive operations and offensive technique	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Higher commanders intent and desired endstate – See perform terrain analysis – See assess enemy situation – See conduct reconnaissance – See conduct mission analysis	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor – See perform terrain analysis – See assess enemy situation – See conduct reconnaissance – See conduct mission analysis	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Array the forces available	**COGNITIVE:** Deductive Reasoning; Information Ordering; Visualization; Spatial Orientation; Memorization; **SENSORY:**	– See determine own force potential combat power – See develop a light infantry course of action – See conduct mission analysis	**COGNITIVE:** Deductive Reasoning; Information Ordering; Visualization; Spatial Orientation; Memorization; **SENSORY:**	– See determine own force potential combat power – See develop a light infantry course of action – See conduct mission analysis	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor

	Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Develop an offensive concept of operations	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Information Ordering; Visualization; Problem Sensitivity; Memorization **SENSORY:** Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– See develop a light infantry course of action – See conduct reconnaissance – See conduct mission analysis – See assess civil considerations	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Information Ordering; Visualization; Problem Sensitivity; Memorization **SENSORY:** Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– See develop a light infantry course of action – See conduct reconnaissance – See conduct mission analysis – See assess civil considerations	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Assign responsibilities	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Speed of Closure; Perceptual Speed; Memorization **SENSORY:** Near Vision; Speech Clarity **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity;	– A way to verbally, orally or pictorially represent the responsibilities for tasks/missions to subordinate units/elements	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Speed of Closure; Perceptual Speed; Memorization **SENSORY:** Near Vision; Speech Clarity **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity;	– Order process where tasks are assigned to units	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	<u>PHYSICAL:</u> None		**<u>PHYSICAL:</u>** None		
Prepare a COA statement and sketch	**<u>COGNITIVE:</u>** Written Expression; Information Ordering **<u>SENSORY:</u>** Near Vision; Visual Color Discrimination **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	– See develop a light infantry COA	**<u>COGNITIVE:</u>** Written Expression; Information Ordering **<u>SENSORY:</u>** Near Vision; Visual Color Discrimination **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>**	– See develop a light infantry COA	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Post-conditions: COA is developed that incorporates the fundamentals of the offense appropriately and meets the criteria of being suitable, acceptable, feasible, distinguishable and complete.					

Score: Good 3.36

Action Item: Conduct Mission Analysis

Doctrine: FM 3-21.10, 5-0

Preconditions: Trainee has received the mission; Trainee has issued a warning order (WARNO)

Tasks:

1. Analyze Mission
   a. Purpose
   b. Tasks
   c. Constraints
   d. Develop a Restated Mission
2. Conduct Terrain Analysis (Separate Evaluation)
3. Analyze Enemy Situation (Separate Evaluation)
4. Develop Commander Critical Information Requirements (CCIR)
5. Conduct Troop Analysis (Separate Evaluation)
6. Conduct analysis of available time
7. Analyze Civil Considerations (Separate Evaluation)
8. Conduct a risk assessment
9. Identify tentative decisive points based on conclusions and intuition
10. Develop a commander's intent
11. Issue a warning order

Post-conditions: Trainee unit's mission is known; Trainee comprehends the current situation ; Trainee has a conceptual understanding of how his unit will accomplish the mission; Trainee has identified potential risks of the operation.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Comments:

Mission analysis is a deliberate and detailed process that may be modified to suit the tactical situation. FSC provides the trainee with an environment where MA may be executed at various levels depending on how complete the scenario is. As noted previously in other analyses, the ability to issue a warning order does not exist in FSC. Additionally, risk assessment and management may only be done in a perfunctory manner using FSC. Much of this task is dependent upon the level of detailed information provided to the trainee in the battalion OPORD.

FSC supports this action item. Overall rating: **Good**

Real World (RW) Preconditions: Trainee has received the mission; Trainee has Issued a warning order (WARNO)			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Analyze the Mission	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Trainee must have been given a mission with implied, specified and critical tasks. The mission should have a timeline for completion. – The information provided to the trainee should answer the questions of who, what, where, when and why or the trainee should be able to process the given information to draw inferences that answer the questions – Trainee must be able to review the higher commanders order and parse information that he deems necessary. The environment should support the trainee in parsing information, drafting plans and identifying tasks his unit must accomplish – Environment should support the	**COGNITIVE:** Written Comprehension; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity; Visualization; Speed of Closure; **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor and higher HQ order – Trainee not able to draft a mission statement	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

		development and drafting of a mission statement			
Conduct Terrain Analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Analyze Enemy Situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Develop Commander Critical Information Requirements (CCIR)	**COGNITIVE:** Oral Expression; Oral Comprehension; Written Comprehension; Written Expression; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity;	– Trainee must be provided with materials (i.e., intelligence materials) that provide or support the inference of CCIR. – Tools to author, refine and transmit CCIR's to trainee's unit via voice or digital means. – A way to denote and link CCIR to the operational plan.	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario may provide higher headquarters CCIR if included in the OPORD. – No ability for the trainee to develop or denote CCIR for his unit or transmit CCIR as part of the COA/OPORD for execution.	5 – Excellent 4 – Very Good 3 – Good *2 – Fair 1 – Poor

	PHYSICAL: None				
Conduct Troop Analysis	See determine own force potential combat power	See determine own force potential combat power	See determine own force potential combat power	See determine own force potential combat power	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Conduct analysis of available time	**COGNITIVE:** Written Comprehension; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Number Facility; Speed of Closure; Selective Attention; Time Sharing; **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** None **PHYSICAL:** None	– Time context i.e., the present time or a scripted future or past time. – Trainee must have a starting time from which to plan from and against. – Orders must specify a time or time frame for mission accomplishment so that the trainee may execute this analysis. – A way to develop and transmit a timeline for mission accomplishment	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Number Facility; Time Sharing **SENSORY:** Near Vision; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Game allows for play to go from 30 min to 4:30 in 30 min increments – Time my begin during planning phase if selected – Scenario may provide information relating to when mission must start and be completed by. – Time is annotated on the CDR POV screen during execution of mission – Trainee unable to develop, display or transmit a timeline	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Analyze Civil Considerations	See assess civil considerations	See assess civil considerations	See assess civil considerations	See assess civil considerations	5 – Excellent 4 – Very Good 3 – Good *2 – Fair 1 – Poor
Conduct a risk assessment	**COGNITIVE:** Oral Comprehension; Written Comprehension;	– See analyze enemy situation – See perform terrain analysis	**COGNITIVE:** Written Comprehension; Deductive Reasoning;	– No risk management plan, template or functionality is explicitly included in	5 – Excellent *4 – Very Good 3 – Good 2 – Fair

	Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See determine own force potential combat power – Environment must support the development of a risk management plan for the unit that identifies risks and controls	Inductive Reasoning; Problem Sensitivity; Visualization; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	the game. All risk management functionality is implicitly included in other activities.	1 – Poor
Identify tentative decisive points based on conclusions and intuition	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity;	– Scenario that contains information that supports the trainee in the identification and development of decisive points that define how, where, or when the unit will accomplish its purpose. – Information from intelligences sources about the enemy and the higher commanders intent and vision – A way to denote or annotate decisive	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:**	– Scenario editor provides ability to include pertinent information to OPORD – Intelligence materials may be developed and added to background and OPORD	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor

	PHYSICAL: None	points in the order or on the COA sketch.	None		
Develop a commanders intent	**COGNITIVE:** Written Expression; Deductive Reasoning; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Outputs from previously identified steps – See analyze enemy situation – See perform terrain analysis – See determine own force potential combat power – See conduct reconnaissance – See develop a light infantry company course of action –	**COGNITIVE:** Written Expression; Deductive Reasoning; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See analyze enemy situation – See perform terrain analysis – See determine own force potential combat power – See conduct reconnaissance – See develop a light infantry company course of action – COA/Order development process does not include the ability to express the CI.	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor **Math: this step includes evaluation of each step for this subtask as well as all of the steps from all of the previous subtasks. If subtask was roll up of others then just the score from the umbrella subtask was used to eliminate double and triple counting. This score 3.25
Issue a warning order	**COGNITIVE:** Written Comprehension, Oral Expression, Written Expression; **SENSORY:** Near Vision; Speech Clarity **PSYCHOMOTOR:** Arm Hand Steadiness; Manual Dexterity; Finger Dexterity;	– Correct order format – Means to deliver the WO – Information from previous steps	**COGNITIVE:** None **SENSORY:** None **PSYCHOMOTOR:** None **PHYSICAL:** None	– No warning order functionality exists within FSC	5 – Excellent 4 – Very Good 3 – Good *2 – Fair 1 – Poor **Step would have been rated as poor if affordances not treated equally.

	PHYSICAL: Extent Flexibility				
Post-conditions: Trainee unit's mission is known; Trainee comprehends the current situation; Trainee has a conceptual understanding of how his unit will accomplish the mission; Trainee has identified potential risks of the operation					

Score: Very Good 4.00

Action Item: Plan Breaching Operations

Doctrine: FM 3-21.10, 5-0

Preconditions: Mission order received directing unit to conduct breaching operations as part of or as their mission; Task organization for mission is provided; Breaching assets are allocated and provided to trainee.

Task: Trainee applies the five tenants of planning for breach operations: intelligence, fundamentals, organization, mass and synchronization.

1. Trainee evaluates the enemy situation and applies this information to his plan
2. Trainee considers the terrain and how it supports breach execution (approach routes; primary/alternate breach point; SBF position; fire support positioning)
3. Trainee organizes his assets (i.e., support, breach and assault forces and security element)
4. Trainee applies the fundamentals of breaching (SOSRA) suppress, obscure, secure, reduce, and assault in planning
5. Trainee synchronizes the positioning and effects of all aspects of breaching through the use of control measures
6. Trainee authors the plan.

Post-conditions: Synchronized breaching plan developed.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Results:

FSC contains a scenario editor that provides the opportunity to develop scenarios requiring breaching. The trainee is able to conduct limited planning and synchronization during both planning and during execution of breaching operations.

FSC supports the training of this action item. Overall rating: **Very Good**

Real World (RW) Preconditions: Mission order received directing unit conduct breaching operations as part of or as their mission; Task organization provided; Breaching assets allocated			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Limit of Support to Training**
Trainee evaluates the enemy situation and applies this information to his plan.	– See analyze enemy situation	– See analyze enemy situation	– See analyze enemy situation	– See analyze enemy situation	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee considers the terrain and how it supports breach execution (approach routes; primary/alternate breach point; SBF position; Fire support positioning)	– See perform terrain analysis	– See perform terrain analysis	– See perform terrain analysis	– See perform terrain analysis	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee organizes his assets recognizing strengths and weaknesses (i.e., Support, Breach and Assault Forces & Security element)	– See determine own force potential combat power	– See determine own force potential combat power	– See determine own force potential combat power	– See determine own force potential combat power	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee applies the fundamentals of breaching (SOSRA) suppress, obscure, secure, reduce, and assault in planning	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Memorization **SENSORY:** Near Vision; Visual	– Tools that allow the trainee to develop and manipulate a breaching plan (e.g., alcohol pens, mission command systems) – See develop a light infantry company COA	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; **SENSORY:** Near Vision; Visual Color Discrimination **PSYCHOMOTOR:**	– Game order planning screen allows trainee to build plan and adjust as desired	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None		Manual Dexterity; Finger Dexterity **PHYSICAL:** None		
Trainee synchronizes the positioning and effects of all aspects of breaching through the use of control measures	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Memorization **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:**None	– A method and tools (e.g., mission command system) for developing a plan – Doctrinal graphical symbology (e.g., control measures) – See develop a light infantry company COA – A method to conduct time and battlespace synchronization during planning	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– OPORD planning screen allows trainee to build a plan using phases and other limited doctrinal control measures – Phase lines, breach symbol – See develop a light infantry COA	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee authors the plan	**COGNITIVE:** Oral Expression; Written Expression; **SENSORY:** Near Vision, Visual Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Tools to draft/build the plan (e.g., maps, acetate, alcohol pens, mission command system) – A way to depict the plan so others may see and understand it (e.g., butcher boards, mission command systems)	**COGNITIVE:** Written Expression; **SENSORY:** Near Vision, Visual Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Game provides functionality to develop an order that includes breaching information	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Post-conditions: Synchronized plan for breaching an obstacle exists					

Score: Very Good 4.00

Action Item: Apply the fundamentals of conducting a movement to contact (MTC)

Doctrine: FM 3-21.10, 3-90

Preconditions: Mission order received directing unit to conduct offensive operations to gain intelligence or contact with an enemy force; Trainee is knowledgeable of doctrine about how to conduct a MTC and the fundamentals of conducting a MTC; Trainee is proficient in the development of MTC COA

Tasks:

1. Develop a plan/COA that includes the following fundamentals:
   a. Focus all reconnaissance efforts on finding the enemy
   b. Make contact with the enemy using the smallest element possible (visual contact preferred)
   c. Avoid decisive engagement with the main body until conditions are favorable
   d. Maintain freedom of maneuver and mutual support between and within unit elements
   e. Maintain contact with the enemy
2. Command and control the execution of the plan

Post-conditions: Contact made with the enemy on favorable terms; Unit achieves tactical/operational objectives

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Comments:

FSC supports the development and depiction of courses of action as orders and fragmentary orders. The game does not support separate COA development from order development. Users are able to develop plans that incorporate the fundamentals of MTC. Trainees are unable to physically C2 their elements on the field but may do so through an avatar that represents them in the game. The commander may make adjustments to his plan during execution and interact with his forces via simulated radio communications. The limited intelligence of the avatars prevents adherence to the fundamentals of MTC which is a problem however that does not significantly affect the trainee's ability to react to the contact.

FSC supports this action item. Overall rating: **Very Good**

Real World (RW) Preconditions: Mission order received directing unit to conduct offensive operations to gain intelligence or contact with an enemy force**;** Trainee is knowledgeable of doctrine about how to conduct a MTC and the fundamentals of conducting a MTC; Trainee is proficient in the development of MTC COA			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Develop a course of action that includes: – Focus all reconnaissance efforts on finding the enemy – Make contact with the enemy using the smallest element possible (visual contact preferred) – Avoid decisive engagement with the main body until conditions are favorable – Maintain freedom of maneuver and mutual support between and within unit elements – Maintain contact with the enemy	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Fluency of Ideas; Information Ordering; Mathematical Reasoning; Speed of Closure; Memorization; Selective Attention **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Higher Commanders intent and desired operational endstate – See determine own force potential combat power – See perform terrain analysis – See assess enemy situation – See develop a light infantry course of action – Intelligent Soldiers that are knowledgeable of MTC fundamentals and doctrine	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Fluency of Ideas; Information Ordering; Memorization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor allows for the inclusion of commanders intent and desired endstate. – Planning tab includes an orders development capability that allows the trainee to build an Order. – Trainee does not have any control over the movement of the individual avatars	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Command and Control the execution of the plan	**COGNITIVE:** Oral Expression; Oral Comprehension; Written	– Intelligent Soldiers that are knowledgeable of MTC fundamentals	**COGNITIVE:** Oral Comprehension; Written Comprehension;	– Scenario representing environment, higher commander and own	5 – Excellent *4 – Very Good 3 – Good 2 – Fair

	Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Selective Attention; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination;	and doctrine – Tactical scenario that provides a higher commander, enemy and physical environment. – Verbal or digital communication capability between the trainee, his unit elements and his higher headquarters. – Physical or visual interaction between the trainee, his subordinate elements, his higher headquarters and the enemy. – Environment should afford the trainee a way to adjust his plan and issue new orders during the scenario as in real life.	Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Information Ordering; Spatial Orientation; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	unit elements and enemy – Limited scripted simulated radio communications – Limited simulated visual/physical contact with enemy, own troops and higher headquarters – FRAGO capability is present	1 – Poor ** This item would be rated as Fair due to the limited interaction between the game entities and the trainee if affordances were not all considered equal

	PHYSICAL: Explosive Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium				
Issue a Fragmentary Order [FRAGO] (as needed)	See issue a fragmentary order	See issue a fragmentary order	See issue a fragmentary order	See issue a fragmentary order	See issue a fragmentary order
Post-conditions: Contact made with the enemy on favorable terms; Unit achieves tactical/operational objectives					

Score: Very Good 4.00

Action Item: Integrate Fire Support Into Urban Operations

Doctrine: FM 3-21.10

Preconditions: Mission order provided to trainee; Fire support assets available to the trainee are specified; Trainee is knowledgeable on urban operations (UO) doctrine, the current ROE for use of indirect fire/mortars and the enemy situation.

Tasks:

1. Process information on the capabilities of own unit and general fire support assets available
2. Process information concerning the enemy's capabilities and possible use of urban terrain
3. Process information concerning the ROE and any civil considerations affected by the use of indirect fire/mortars
4. Develop a fire support plan for the mission

Post-conditions: Fire Support plan is developed; Fire Support Coordination and Control measures are known by the unit; Fire support is integrated into the movement and maneuver plan.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Results:

FSC only includes those organic indirect fire assets resident in a light infantry company (i.e., mortars). Trainees are provided information about the use/restriction of mortars depending on the scenario that is editable. FSC only provides scaffolding in the form of graphic control measures necessary to control or activate indirect fires for two types of missions. Trainees have the ability using FSC to think through how they would employ mortar assets in support of a maneuver plan.

FSC supports this action item. Overall rating: **Very Good**

<table>
<tr><td colspan="3">Real World (RW) Preconditions: Mission order provided to trainee; Fire support assets available to the trainee are specified; Trainee is knowledgeable on Urban Operations (UO) doctrine, the current ROE for use of indirect fire/mortars and the enemy situation</td><td colspan="3">Environment Evaluation</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Limit of Support to Training</th></tr>
<tr><td>Process information on the capabilities of own unit and general fire support assets available</td><td><u>COGNITIVE:</u>
Written Comprehension; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Speed of Closure

<u>SENSORY:</u>
Near Vision; Speech Recognition

<u>PSYCHOMOTOR:</u>
None

<u>PHYSICAL:</u>
None</td><td>– See assessment of determine own force potential combat power.
– Information about any additional fire support assets allocated for the unit’s use during an operation (e.g., size, number, etc.)</td><td><u>COGNITIVE:</u>
Written Comprehension; Inductive Reasoning; Problem Sensitivity; Speed of Closure

<u>SENSORY:</u>
Near Vision;

<u>PSYCHOMOTOR:</u>
Manual Dexterity, Finger Dexterity

<u>PHYSICAL:</u> None</td><td>– Editable scenario that may provide detail as necessary
– Default force structure that includes mortar assets</td><td>*5 – Excellent
4 – Very Good
3 – Good
2 – Fair
1 – Poor</td></tr>
<tr><td>Process information concerning the enemy’s capabilities and possible use of urban terrain</td><td><u>COGNITIVE:</u>
Written Comprehension; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Memorization

<u>SENSORY:</u>
Near Vision; Speech Recognition</td><td>– See analyze enemy situation
– See perform terrain analysis</td><td><u>COGNITIVE:</u>
Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization;

<u>SENSORY:</u>
Near Vision

<u>PSYCHOMOTOR:</u>
None</td><td>– See analyze enemy situation
– See perform terrain analysis</td><td>5 – Excellent
*4 – Very Good
3 – Good
2 – Fair
1 – Poor</td></tr>
</table>

	PSYCHOMOTOR: None **PHYSICAL:** None		**PHYSICAL:** None		
Process information concerning the ROE and any civil considerations affected by the use of indirect fire/mortars	**COGNITIVE:** Written Comprehension; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Memorization **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** None **PHYSICAL:** None	– ROE considerations dealing with indirect fires/mortars – See assess civil considerations	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Adjustable ROE setting and information – See assess civil considerations	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Develop a fire support plan for the mission that considers the use of high explosive, smoke and illumination ordinance and targets that support the execution of the tactical plan	**COGNITIVE:** Written Expression; Deductive Reasoning; Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Spatial Orientation; Speed of Closure; Memorization; **SENSORY:** Near Vision **PSYCHOMOTOR:**	– See assessment for develop a light infantry COA. – See perform terrain analysis – Means to graphically display fire control measures on the area of operations – Necessary doctrinal symbology – A means to coordinate fire support with outside sources if	**COGNITIVE:** Written Expression; Deductive Reasoning; Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Speed of Closure; **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity;	– See develop a light infantry COA – See perform terrain analysis – Ability to place targets and task mortars – TRP and Illumination symbols only	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	required	Finger Dexterity; **<u>PHYSICAL:</u>** None		
Post-conditions: Fire Support plan is developed; Fire Support Coordination and Control measures are known by the unit; Fire support is integrated into the movement and maneuver plan					

Score: Good 3.00

Action Item(s): Issue Infantry Company or Company-Team Operations Order (OPORD)

Doctrine: FM 5-0, 3-21.10

Preconditions: Trainee has received an operations order from his/her higher headquarters with supporting materials (e.g., graphics, enemy situational templates); Trainee has conducted a preliminary mission analysis on the higher commanders order; Trainee has developed a 5-paragraph operations order to provide direction to a unit for the execution of a mission.

Task:

1. Issue the OPORD Verbally

2. Issue the OPORD Digitally

Post-conditions: New information has been transmitted from commander to unit; Unit elements acknowledge receipt of OPORD.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Results:

FSC supports the digital transmission of a matrix style OPORD to the simulated unit. The matrix order does not cover the 5 paragraphs of the standard written format. There is no way to enhance the order via the scenario editor. Despite this, order information is transmittable for unit execution.

FSC supports the training of this action item. Overall Rating: **Good**

Real World (RW) Preconditions: Trainee has received an operations order from his/her higher headquarters with supporting materials (e.g., graphics, enemy situational templates); Trainee has conducted a preliminary mission analysis on the higher commanders order; trainee has developed a 5-paragraph operations order to provide direction to a unit for the execution of a mission.			**Environment Evaluation** OPORD developed by users of FSC is a matrix style order that does not follow doctrinal guidelines.		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Issue OPORD verbally – Read OPORD – Verbally transmit information	**COGNITIVE:** Written Comprehension; Oral Expression **SENSORY:** Near Vision; Speech Clarity **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– 5-paragraph OPORD – A means to amplify the voice so that transmission of the OPORD may occur if the audience is not within hearing range (e.g., radio)	**COGNITIVE:** None **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Simulated unit – No means to verbally transmit information – Matrix order	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor **Task would be rated Poor if task elements were not treated equally.
Issue OPORD digitally	**COGNITIVE:** Deductive Reasoning; **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– 5-paragraph OPORD – A way to digitally deliver or transmit the order (e.g., mission command system)	**COGNITIVE:** Deductive Reasoning **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Simulated digital transmission of OPORD – Simulated unit – Matrix order	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Post-conditions: New information has been transmitted from commander to unit; Unit elements acknowledge receipt of OPORD.					

Score: Good 2.66

Action Item: Conduct Reconnaissance

Doctrine: FM 5-0, 3-21.10

Preconditions: Trainee receives mission orders (WARNO, FRAGO OPORD) from a higher headquarters; Trainee is proficient with the troop leading procedures and METT-TC; Trainee has executed steps 1–4 of the TLP; Trainee is familiar with mission analysis.

Task: Reconnoiter

1. Trainee identifies areas of his tentative plan where reconnaissance is necessary to complete the plan.
2. Trainee identifies/derives information requirements (IR)
3. Trainee determines the type of reconnaissance to conduct based on METT-TC considerations and IRs.
   a. Physical (i.e., Key leader reconnaissance of the ground)
   b. Materials based reconnaissance (i.e., review of materials provided to him by his higher headquarters [e.g., aerial photos, map intelligence])
4. Reconnaissance conducted:
   a. Personally by leader
   b. By tasked elements within unit based on IRs.
5. If trainee assigned elements to conduct reconnaissance, the trainee receives back brief on the results of the reconnaissance so that he can complete his plan.
6. If conducted as part of ongoing operations, trainee repeats steps 3-5 as necessary to maintain a current assessment.

Post-conditions: Reconnaissance of terrain conducted; Reconnaissance of enemy conducted; Information requirements developed and distributed

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis

<u>2–Fair</u> – the ITE contains some (25–49%) of the affordances determined during the analysis
<u>1–Poor</u> – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Comments:

This action item is too vague. Reconnaissance is conducted constantly during military operations both in planning and execution. To reconnoiter using FSC means that physical reconnaissance is not possible leaving the evaluator to consider how well the system supports a trainee's ability to conduct a map reconnaissance. Each of the tactical scenarios provides various map views and often times simulated photography of areas of importance. With these items a trainee is able to conduct one form of reconnaissance of his area of operations. It is possible to fake reconnaissance assignments by tasking units to move to locations where if they encounter the enemy they will engage and report. That would be a form of reconnaissance by fire.

FSC supports this action item. Overall rating: **Good**

Real World (RW) Preconditions: Trainee receives mission orders (WARNO, FRAGO OPORD) from a higher headquarters; Trainee is proficient with the troop leading procedures and METT-TC; Trainee has already executed steps 1-4 of the TLP; Trainee is familiar with mission analysis.			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Trainee identifies areas of his tentative plan where reconnaissance is necessary to complete the plan.	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Perceptual Speed; Time Sharing; Memorization **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See Analyze Enemy Situation – See Perform Terrain Analysis – See Develop a Light Infantry COA – A tentative plan	**COGNITIVE:** Inductive Reasoning; Problem Sensitivity; Visualization; Memorization **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See Analyze Enemy Situation – See Perform Terrain Analysis – See Develop a Light Infantry COA – No development of a reconnaissance plan is possible – No initial plans are developed needing reconnaissance	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Trainee identifies and derives his information requirements (IR)	**COGNITIVE:** Written Expression; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:**	– Higher headquarters information requirements (IR) and commanders critical information requirements (CCIR) – See Analyze Enemy Situation – See Perform Terrain Analysis – A way to capture IRs in words or pictures	**COGNITIVE:** Written Expression; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:**	– Scenario can included IR's and CCIRs from higher commander – See Analyze Enemy Situation – See Perform Terrain Analysis – No capability to capture IRs in pictures or words	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor

	Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Trainee determines the type of reconnaissance to conduct (e.g., map or LDR Recon) based on METT-TC considerations and IRs	**COGNITIVE:** Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Speed of Closure; Time Sharing **SENSORY:** Near Vision; **PSYCHOMOTOR:** None **PHYSICAL:** None	– See Analyze Enemy Situation – See Perform Terrain Analysis – The ability to conduct all forms of reconnaissance	**COGNITIVE:** Inductive Reasoning **SENSORY:** Near Vision; **PSYCHOMOTOR:** None **PHYSICAL:** None	– System limited to map reconnaissance only – See Analyze Enemy Situation – See Perform Terrain Analysis	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Physical reconnaissance	**COGNITIVE:** Problem Sensitivity; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Time Sharing **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Recognition;	– Environment must provide the physical and sensory information (e.g., trees, brush etc.) necessary to replicate the high physical fidelity of conducting reconnaissance. Types of physical actions may include walking, crawling, using optics, navigation with map/GPS etc. – Visual and sensory information of enemy activity for trainee to	**COGNITIVE:** Problem Sensitivity; **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– System does not support physical reconnaissance	5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor

	Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination; Reaction Time; Speed of Limb Movement; **PHYSICAL:** Static Strength; Explosive Strength Dynamic Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	see and comprehend – Replication of friendly and enemy equipment and personnel – Replication of operational terrain and weather – See perform terrain analysis – See analyze civil considerations			
Map Reconnaissance	**COGNITIVE:** Written Comprehension; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; **SENSORY:** Near Vision;	– Computer automation assets (i.e., mission command system) if used for command and control – See perform terrain analysis – See assess enemy situation	**COGNITIVE:** Written Comprehension; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:**	– Scenario editor allows for simple map views and simulated visual intelligence products to be provided to the trainee as part of the Higher headquarters OPORD – Game acts as the default automation asset	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

	<u>PSYCHOMOTOR:</u> Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None		Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None		
If trainee assigned elements to conduct reconnaissance, the trainee receives back brief on the results of the reconnaissance so that he can complete his plan	**<u>COGNITIVE:</u>** Oral Comprehension; Written Comprehension; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **<u>SENSORY:</u>** Near Vision; Speech Recognition; **<u>PSYCHOMOTOR:</u>** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** None	– Visual products associated with the reconnaissance conducted e.g., maps, sketches, and photos taken. – Computer automation to assist visualization (e.g., mission command system) – Verbal reconstruction of reconnaissance conducted	**<u>COGNITIVE:</u>** Oral Comprehension; Inductive Reasoning; Problem Sensitivity; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; **<u>SENSORY:</u>** Near Vision; Speech Recognition; **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** None	– Reports from elements tasked to execute non-reconnaissance type missions that the trainee hopes will provide more information about the enemy	5 – Excellent 4 – Very Good 3 – Good *2 – Fair 1 – Poor
If conducted as part of ongoing operations, trainee repeats steps 3-5 as necessary to maintain a current assessment.					
Post-conditions: Reconnaissance of terrain conducted; Reconnaissance of enemy conducted; Information requirements developed and distributed					

Score: Good 3.50

Action Item: Develop a Light Infantry Course of Action

Doctrine: FM 3-21.10; 5-0

Preconditions: Mission order has been issued and received by the trainee.

Task: Develop a COA

1. Analyze relative combat power (strengths and weaknesses)
2. Generate Options about how to successfully execute the mission
3. Array Forces available based on the options developed to determine troops to task
4. Develop a concept of operations that describes how the leader envisions the operation unfolding, from its start to its conclusion or end state.
5. Assign responsibilities for tasks to subordinate elements by name
6. Prepare a COA statement and sketch that describes the operation

Post-conditions: COA meets the criteria of being suitable, feasible, acceptable, distinguishable, complete.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Comments:

FSC does not separate COA development from the development of the matrix style operations order. This means that the COA that is developed is done so as a matrix style order that the unit will execute if implemented. Trainees are able to array forces, evaluate combat power and assign responsibilities as part of the orders process. Arraying forces is not completed in a generic fashion as intended rather this step and assigning responsibility for tasks are combined. The game does not support the traditional method of developing a concept of operations through both written and graphical form. The game does not support the development of the COA statement.

FSC supports training this action item. Overall rating: **Good**

<table>
<tr><td colspan="3">Real World (RW) Preconditions: Mission order has been issued and received by the trainee.</td><td colspan="3">Environment Evaluation</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of Support to training</th></tr>
<tr><td>Analyze relative combat power (strengths, weaknesses)</td><td><u>COGNITIVE:</u> Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure;

<u>SENSORY:</u>
Near Vision;

<u>PSYCHOMOTOR:</u>
Manual Dexterity;
Finger Dexterity;

<u>PHYSICAL:</u>
None</td><td>– See Determine own force potential combat power
– See Perform Terrain Analysis
– See Assess Enemy Situation
– See Assess Civil Considerations</td><td><u>COGNITIVE:</u> Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure;

<u>SENSORY:</u>
Near Vision;

<u>PSYCHOMOTOR:</u>
Manual Dexterity;
Finger Dexterity;

<u>PHYSICAL:</u>
None</td><td>– See Determine own force potential combat power
– See Perform Terrain Analysis
– See Assess Enemy Situation
– See Assess Civil Considerations</td><td>5 – Excellent
*4 – Very Good
3 – Good
2 – Fair
1 – Poor</td></tr>
<tr><td>Generate Options about how to successfully execute the mission</td><td><u>COGNITIVE:</u> Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Perceptual Speed; Memorization;

<u>SENSORY:</u>
Near Vision

<u>PSYCHOMOTOR:</u>
Manual Dexterity;</td><td>– See Determine own force potential combat power
– See Assess Enemy Situation
– See Perform Terrain Analysis
– See Assess Civil Considerations
– Higher commanders intent, desired endstate, and critical information requirements</td><td><u>COGNITIVE:</u> Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure;

<u>SENSORY:</u>
Near Vision;

<u>PSYCHOMOTOR:</u>
Manual Dexterity;
Finger Dexterity;</td><td>– See Determine own force potential combat power
– See Assess Enemy Situation
– See Perform Terrain Analysis
– See Assess Civil Considerations
– Scenario editor that allows information to be added or deleted from OPORD</td><td>5 – Excellent
4 – Very Good
*3 – Good
2 – Fair
1 – Poor</td></tr>
</table>

	Finger Dexterity; **PHYSICAL:** None		**PHYSICAL:** None		
Array Forces available based on the options developed to determine troops to task	**COGNITIVE:** Information Ordering; Spatial Orientation; Perceptual Speed; Memorization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See Determine own force potential combat power – Tools (a way) that allow the trainee to arrange/rearrange and assign unit elements to meet desired objectives –	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See Determine own force potential combat power – Game allows trainee to assign specific tasks to elements based on their assets and capabilities	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Develop a concept of operations that describes how the leader envisions the operation unfolding, from its start to its conclusion or end state	**COGNITIVE:** Information Ordering; Visualization; Memorization **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Tools to develop a framework that allows the trainee to describe the relationships between activities, events, and tasks, and explains how the tasks will lead to accomplishing the mission. – Tools for the trainee to use to physically depict or sketch out their plan in text or pictorial form	**COGNITIVE:** Written Comprehension; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity;	– As part of the planning screen under order development the trainee builds (sketch out) an OPORD as a COA using symbols representing tasks that may be assigned to units by dragging them into the unit's box.	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor

			PHYSICAL: None		
Assign responsibilities for tasks to subordinate elements by name	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Speed of Closure; Perceptual Speed; Memorization **SENSORY:** Near Vision; Speech Clarity **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– A way to assign or annotate specific tasks or missions to subordinate units by name in writing (words), verbally or using pictures or symbols.	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Order development screen that allows trainee to assign tasks to units by dragging them into the unit's box	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor
Prepare a COA statement and sketch that describes the operation	**COGNITIVE:** Written Expression; Information Ordering **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	Tools to build and display a COA statement and sketch that contains: – A decisive point, and what makes it decisive – A form of maneuver or type of defensive operation – Tasks and purposes of the decisive, shaping, and sustaining operations – Reserve planning priorities – Purposes of critical	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Game only provides an orders development screen where the OPORD is entered in graphical form.	5 – Excellent 4 – Very Good 3 – Good 2 – Fair *1 – Poor

		WFF elements – The desired end state – A statement that describes the COA			
Post-conditions: COA meets the criteria of being suitable, feasible, acceptable, distinguishable, complete					

Score: 4.00 Very Good

Action Item: Issue a Fragmentary Order (FRAGO)

Doctrine: FM 5-0, 3-21.10

Preconditions: Trainee has developed and issued a plan (WARNO, OPORD) to his unit; Original plan requires modifications due to new tactical or operational conditions; Elements of order needing adjustment have been identified.

Task:

1. Develop a fragmentary order as a result of changes to the original plan
2. Issue FRAGO verbally
    a. Read FRAGO
    b. Verbally express information
3. Issue FRAGO as an overlay type order

Post-conditions: New information has been transmitted from commander to unit; Unit elements acknowledge receipt of FRAGO.

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Evaluation Results:

FSC provides trainees the ability to develop and generate fragmentary orders in response to actions encountered in the game that result in the necessity to change the trainee's original plan. FRAGOs are transmitted digitally to artificially intelligent forces that execute actions and report. FRAGO orders are not in the doctrinally specified 5-paragraph format.

FSC supports the training of this action item. Overall rating: **Very Good**

Real World (RW) Preconditions: Trainee has developed and issued a plan (WARNO, OPORD) to his unit; Original plan requires modifications due to new tactical or operational conditions; Elements of order needing adjustment have been identified.			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Develop/draft a 5 paragraph fragmentary order to provide direction to units in contact as a result of changes in battlefield conditions.	**COGNITIVE:** Originality; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Information that indicates that a change in the original order is necessary – 5 paragraph Fragmentary Order Format – A way to place necessary information into the FRAGO format (e.g., typed text or hand written)	**COGNITIVE:** Originality; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Reports of unit contact with the enemy – Reports of unit accomplishment of tasks – Doctrinal symbols representing tasks – Screen that contains task symbols and unit icon representations that allows tasks to be dragged and dropped onto units	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Issue FRAGO verbally – Read FRAGO – Verbally Express information	**COGNITIVE:** Written Comprehension; Oral Expression **SENSORY:** Near Vision; Speech Clarity **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– FRAGO in a written form – A means to amplify the voice so that transmission of the FRAGO may occur if the audience is not within hearing range (e.g., radio) – Audience for receipt of order	**COGNITIVE:** None **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Simulated unit – No means to verbally transmit information	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor ** This item would be rated as Poor if tasks were not considered equally important.
Issue FRAGO digitally	**COGNITIVE:**	– A way to digitally	**COGNITIVE:**	– Simulated digital	*5 – Excellent

	Information Ordering; Spatial Orientation; **<u>SENSORY:</u>** Depth Perception; Near Vision **<u>PSYCHOMOTOR:</u>** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** Extent Flexibility	deliver or transmit the order (e.g., mission command system) – Audience to receive order	Written Comprehension; Oral Expression **<u>SENSORY:</u>** Near Vision **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** None	transmission of FRAGO information to unit – Simulated unit	4 – Very Good 3 – Good 2 – Fair 1 – Poor
Post-conditions: New information has been transmitted from commander to unit; Unit elements acknowledge receipt of FRAGO.					

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APPENDIX F. REVISED ANALYSIS OF FSC

The following pages provide the re-analysis of FSC with the revised 4 point ITEAM Scale.

Action Item: Analyze the Enemy Situation **Good 3.00**

Doctrine: FM 3-21.8, 3-21.10, 5-0

Preconditions: Trainee has knowledge of enemy doctrine and weapons capabilities; Trainee receives information from his higher headquarters including an enemy situational template (SITTEMP), current intelligence assumptions regarding enemy capabilities (i.e., composition, disposition, strength and recent activities); Trainee has conducted an analysis of the terrain and weather conditions within the area of interest and area of operations.

Task: Analyze the Enemy Situation

1. Trainee processes all provided information about the enemy capabilities with his own knowledge of and experience with the threat.
2. Trainee reviews the current enemy situational template depicting the disposition of forces
3. Trainee considers the enemy intelligence information in conjunction with the terrain and weather data provided
4. Trainee repeats steps 1–3 as new information becomes available.

Post-conditions: Trainee has understanding of current enemy situation; Trainee has insight into possible future enemy courses of action

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Trainee has knowledge of enemy doctrine and weapons capabilities; Trainee receives information from his higher headquarters including an enemy situational template (SITTEMP), current intelligence assumptions regarding enemy capabilities (i.e., composition, disposition, strength and recent activities); Trainee receives current information about weather and terrain conditions within the area of interest and area of operations			**Environment Evaluation** Enemy situational template is not provided by the system.		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Trainee processes the information provided to him about the enemy with his own knowledge of and experience with the threat	**<u>COGNITIVE:</u>** Oral comprehension; Written comprehension; Inductive Reasoning; Problem Sensitivity; Spatial Orientation; Speed of Closure; Memorization **<u>SENSORY:</u>** Near Vision **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** None	– Composition and strength of enemy force – Enemy most likely course of action – Enemy weapons capabilities – Current and probable locations of enemy forces – Recent enemy activity in the area – Any tools necessary to annotate, arrange or depict information for analysis (e.g., acetate, map, alcohol pens, written order, paper, pencil, mission command systems)	**<u>COGNITIVE:</u>** Oral comprehension; Written comprehension; Inductive Reasoning; Problem Sensitivity; Speed of Closure; Memorization **<u>SENSORY:</u>** Near Vision **<u>PSYCHOMOTOR:</u>** Manual Dexterity, Finger Dexterity **<u>PHYSICAL:</u>** None	– Scenario editor allows for enemy information to be included as part of the operations order	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee reviews the enemy situational template	**<u>COGNITIVE:</u>** Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity	– Enemy Situational Template – Map of operational area with appropriate graphics and symbols represented	**<u>COGNITIVE:</u>** Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity	– Enemy Situational template not provided	4 – Very Good 3 – Good 2 – Fair *1 – Poor

<table>
<tr><td></td><td><u>SENSORY:</u>
Near vision;

<u>PSYCHOMOTOR:</u>
Manual Dexterity;
Finger Dexterity

<u>PHYSICAL:</u> None</td><td>– Any mission command systems that are used to assist in organizing or analyzing enemy information
– See perform terrain analysis</td><td><u>SENSORY:</u>
Near Vision

<u>PSYCHOMOTOR:</u>
Manual Dexterity;
Finger Dexterity

<u>PHYSICAL:</u> None</td><td></td><td></td></tr>
<tr><td>Trainee considers enemy information in conjunction with terrain and weather data</td><td><u>COGNITIVE:</u>
Deductive Reasoning;
Inductive Reasoning;
Problem Sensitivity;
Speed of Closure;
Memorization

<u>SENSORY:</u>
None

<u>PSYCHOMOTOR:</u>
None

<u>PHYSICAL:</u>
None</td><td>– Light and weather data
– Information about terrain and weather from previous analysis. (See perform terrain analysis)
– Enemy information from step 1 (i.e., disposition, composition, suspected locations, likely actions)</td><td><u>COGNITIVE:</u>
Deductive Reasoning;
Inductive Reasoning;
Problem Sensitivity;
Speed of Closure;
Memorization

<u>SENSORY:</u>
None

<u>PSYCHOMOTOR:</u>
None

<u>PHYSICAL:</u>
None</td><td>– Scenario editor allows for the inclusion of Terrain and Weather data as part of the battalion operations order.</td><td>*4 – Very Good
3 – Good
2 – Fair
1 – Poor</td></tr>
<tr><td colspan="6">Post-conditions: Trainee has understanding of current enemy situation; Trainee has insight into possible future enemy courses of action</td></tr>
</table>

Score: Very Good 4.00

Action Item: Perform Terrain Analysis

Doctrine: FM 5-0, 3-21.10

Preconditions: Trainee has been issued a mission order and understands his AO and AI; Trainee is familiar with troop leading procedures, mission analysis and METT-TC; Trainee has conducted steps 1 and 2 of the troop leading procedures

Task: Conduct a terrain analysis from a map and materials provided by the higher headquarters using the acronym OAKOC (Obstacles, Avenues of Approach, Key Terrain, Observation and Fields of Fire, Cover and Concealment).

Post-conditions: Terrain Analysis answers the question: What is the terrain's effect on the operation?; Graphical Display of the Terrain (GDOT) produced

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Trainee has been issued a mission order and understands his AO and AI; Trainee is familiar with troop leading procedures, mission analysis and METT-TC; Trainee has conducted steps 1 and 2 of the troop leading procedures			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Conduct a terrain analysis from a map and materials provided by the higher headquarters using the acronym OAKOC (Obstacles, Avenues of Approach, Key Terrain, Observation and Fields of Fire, Cover and Concealment).	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Memorization **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Paragraph 1 of OPORD that provides information from higher headquarters about the terrain and weather. – Maneuver Combined Obstacle Overlay from higher headquarters – Representation of the terrain that the trainee will maneuver over (e.g., map, aerial photographs) – Intelligence information about enemy emplaced, natural or man-made obstacles known by the higher headquarters	**COGNITIVE:** **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor allows for as much or as little detail as desired in paragraph 1 of the OPORD. – Scenario editor allows maps and simulated photography to be provided in the scenario. – No MCOO functionality exists in the game	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee repeats analysis as necessary to maintain a current assessment					
Post-conditions: Answer provided to question: What is the terrain's effect on the operation?; Graphical Terrain Analysis Overlay (GTAO) developed					

Score: Fair 2.00

Action Item: Conduct an AAR

Doctrine: TC 25-20; AR 11-13

Preconditions: Mission or exercise has concluded or been stopped; Type/Format of AAR decided.

Task: Conduct an AAR

Post-conditions: Trainee has a better understanding of events and how his actions influenced mission outcomes.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

<table>
<tr><td colspan="3">Real World (RW) Preconditions: Mission or exercise has concluded or been stopped; Type/Format of AAR decided</td><td colspan="3">Environment Evaluation</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of support to training</th></tr>
<tr><td>Conduct an AAR:

– During or immediately after each event
– Focus on intended training objectives
– Focus on soldier, leader and unit performance
– Involve all participants in the discussion.
– Use open-ended questions.
– Are related to specific standards.
– Determine strengths and weaknesses.
– Link performance to subsequent training.</td><td><u>COGNITIVE:</u>
Oral Expression; Oral Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure; Perceptual Speed

<u>SENSORY:</u>
Near Vision; Visual Color Discrimination; Speech Clarity; Speech Recognition;

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity; Reaction Time;

<u>PHYSICAL:</u> Stamina; Gross Body Equilibrium</td><td>– A way to identify, recreate or represent significant events that occurred during training
– Representation or replication of trainee performance at identified key points in training
– A Facilitator
– Training Audience
– Training Objectives
– Doctrinal references/info</td><td><u>COGNITIVE:</u>
Inductive Reasoning; Problem Sensitivity; Information Ordering; Speed of Closure; Perceptual Speed

<u>SENSORY:</u>
Near Vision; Visual Color Discrimination;

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity;

<u>PHYSICAL:</u>
None</td><td>– Recording of mission
– Statistics dealing with weapon use (e.g., mortars, grenade, satchel charges and javelins)
– Weapon distributions and ammo expenditure
– Casualties
– Blue force plan OPORD
– Red force plan
– Review screen that allows players to view operation and stop at decision points to view specific events
– Explainable AI that allows preformatted questions to be asked of Soldiers to determine what was going on at that time.</td><td>4 – Very Good
3 – Good
*2 – Fair
1 – Poor</td></tr>
<tr><td colspan="6">Post-conditions:
Trainee has a better understanding of events and how his actions influenced mission outcomes.</td></tr>
</table>

Score: Good 3.00

Action Item(s):
Synchronize a light company team attack in an urban operation
Synchronize the engineer portion of a light infantry company attack
Synchronize the indirect fires portion of a light infantry company attack

Doctrine: FM 3-21.10

Preconditions: Trainee has received a mission order; Trainee has knowledge of doctrine dealing with offensive and urban operations; Trainee has knowledge about how to plan indirect fires and breaching operations.

Task (s):

1. Integrate the following to develop a course of action:

   Apply selected steps of the Troop Leading Procedures (Partially Evaluated)
   Conduct Mission Analysis (Partially evaluated)
   Analyze civil considerations (Evaluated)
   Analyze enemy situation (Evaluated)
   Perform terrain analysis (Evaluated)
   Develop a course of action for a light infantry company (Evaluated)
   Conduct Reconnaissance (Evaluated)
   Determine own force potential (Evaluated)
   Integrate the fundamentals of the offense into a COA (Evaluated)
   Integrate fire support into urban operations (Evaluated)
   Plan breaching operations (Evaluated)
   Select a COA (Evaluated)
   Issue a FRAGO (Evaluated)

2. Command and control the execution of the plan.

Post-conditions: Plan is developed and actions are synchronized; Plan is executed and adjustments are made based on changing battlefield conditions

DEFINITION OF SCALE

<u>4–Very Good</u>—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
<u>3–Good</u>—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis

2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Trainee has received a mission order; Trainee has knowledge of doctrine dealing with offensive and urban operations; Trainee has knowledge about how to plan indirect fires and breaching operations			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Apply selected troop leading procedures	See apply selected troop leading procedures	See apply selected troop leading procedures	See apply selected troop leading procedures	See apply selected troop leading procedures	4 – Very Good 3 – Good *2 – Fair 1 – Poor
Conduct Mission Analysis	See conduct mission analysis	See conduct mission analysis	See conduct mission analysis	See conduct mission analysis	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Analyze civil considerations	See analyze civil considerations	See analyze civil considerations	See analyze civil considerations	See analyze civil considerations	4 – Very Good 3 – Good *2 – Fair 1 – Poor
Analyze enemy situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Perform terrain analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Develop a course of action for a light infantry company	See develop a light infantry company course of action	See develop a light infantry company course of action	See develop a light infantry company course of action	See develop a light infantry company course of action	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Conduct Reconnaissance	See conduct reconnaissance	See conduct reconnaissance	See conduct reconnaissance	See conduct reconnaissance	4 – Very Good 3 – Good *2 – Fair 1 – Poor
Determine own force potential	See determine own force potential combat power	See determine own force potential combat power	See determine own force potential combat power	See determine own force potential combat power	*4 – Very Good 3 – Good 2 – Fair

					1 – Poor
Integrate the fundamentals of the offense into a COA	See integrate the fundamentals of the offense into a COA	See integrate the fundamentals of the offense into a COA	See integrate the fundamentals of the offense into a COA	See integrate the fundamentals of the offense into a COA	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Integrate fire support into urban operations	See integrate fire support into urban operations	See integrate fire support into urban operations	See integrate fire support into urban operations	See integrate fire support into urban operations	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Plan breaching operations	See plan breaching operations	See plan breaching operations	See plan breaching operations	See plan breaching operations	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Select a COA	See select a course of action	See select a course of action	See select a course of action	See select a course of action	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Issue a FRAGO	See issue a FRAGO	See issue a FRAGO	See issue a FRAGO	See issue a FRAGO	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Command and Control Execution (Supervise)	**COGNITIVE:** Oral Expression; Oral Comprehension; Written Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization;	– Elements to command and a tactical scenario in which to control them. – Scenario providing representations of the higher commander, the enemy, the physical environment and the enemy. – The environment should afford radio communications between the trainee, his unit elements and his higher	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination	– AI Unit – Higher HQ – Game acts as mission command system during execution – Tactical scenario – Interaction through scripted messages, simulated radio traffic and FRAGO orders – FRAGO capability	*4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Selective Attention; Time Sharing; **<u>SENSORY:</u>** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **<u>PSYCHOMOTOR:</u>** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination; **<u>PHYSICAL:</u>** Explosive Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	headquarters. – The environment should afford interaction between the trainee, his subordinate elements, his higher headquarters and the enemy. – Environment should afford the trainee a way to adjust his plan and issue new orders during the scenario as in real life.	**<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None		
Post-conditions: Plan is developed and actions are synchronized; Plan is executed and adjustments are made based on changing battlefield conditions					

Score: Very Good 4.00

Action Item: Determine own force potential combat power

Doctrine: FM 3-21.10

Preconditions: Trainees receive a mission order and a task organization for execution of the mission for their unit.

Task: Determine force combat power: Identify all available organic and non-organic unit assets available to determine the unit's strength, composition and capabilities.

Post-conditions: Trainees have an understanding of the composition, strength and capabilities of all assets available to them for their assigned mission.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Trainee receives a mission order and a task organization for execution of the mission for his unit.			**Environmental Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of support to training**
Trainees identify all available organic and non-organic assets available to them to determine their unit's strength, composition and capabilities.	**<u>COGNITIVE:</u>** Written Comprehension; Oral Comprehension; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Visualization; Perceptual Speed; Memorization; **<u>SENSORY:</u>** Near Vision; Speech Recognition **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	– Information about available assets for the trainee to use to accomplish his mission. – Information about strengths and weaknesses of unit equipment and personnel. – Friendly weapons capabilities, status and number – Tools that assist the trainee in annotating, arranging or depicting own unit information for analysis (e.g., acetate, map, alcohol pens, written order, paper, pencil, computer screens)	**<u>COGNITIVE:</u>** Written Comprehension; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Memorization; **<u>SENSORY:</u>** Near Vision; **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	– Task organization for trainee's unit – Notification of additional assets provided to support trainee – Scenario editor that allows the trainer to increase or decrease the amount of information about the unit or attachments depending on the intent of the training.	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Post-conditions: Trainee has an understanding of the composition, strength and capabilities of all assets available to him for his assigned mission.					

Score: Good 3.00

Action Item: Select a Course of Action (COA)

Doctrine: FM 3-21.10, 5-0

Preconditions: Trainee is familiar with the troop leading procedures; Trainee is familiar with the execution of mission analysis and course of action development; Trainee has developed at least 2 courses of action; All courses of action have been evaluated for their suitability, completeness, feasibility, distinctness and completeness.

Task: Select a COA that meets the requirements of the battalion commander's intent, achieves the company's purpose, maximizes the effects of terrain, minimizes casualties, and is within the company's capabilities.

Post-conditions: Best COA is selected from available alternatives that satisfies the need and operational conditions

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

**Note: FM 3-21.10 states that at the company level only one COA is usually generated. At higher levels more that one course of action is developed and compared making the selection process a more formal one.

Real World (RW) Preconditions: Trainee is familiar with the troop leading procedures; Trainee is familiar with the execution of mission analysis and course of action development; Trainee has developed at least 2 courses of action; All courses of action have been evaluated for their suitability, completeness, feasibility, distinctness and completeness			**Environment Evaluation** System allows for the development of only 1 COA that is the operations order that is issued to the unit.		
Tasks	**Human Abilities**	**Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Select a course of action	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity **SENSORY:** Near Vision **PSYCHOMOTOR:** None **PHYSICAL:** None	– A course of action that has been developed. – A means to physically select or annotate selection of one COA	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– The ability to develop an operations order that contains a course of action that is issued to the unit for execution.	4 – Very Good *3 – Good 2 – Fair 1 – Poor **This item should be rated as Poor because the system does not allow the development and selection of a COA separate from the development of the operations order.
Post-conditions: Best COA is selected from available alternatives that satisfies the need and operational conditions					

Score: Good 2.63

Action Item: Apply Selected Troop Leading Procedures

Doctrine: FM 3-21.10, 5-0

Preconditions: Headquarters has issued a mission type order.

Tasks:

1. Receive the mission and conduct analysis of its contents
2. Issue a warning order to unit to allow them to begin parallel planning
3. Make a tentative Plan that will be the basis for the OPORD
4. Initiate movement of unit elements so that they may be prepared for initiation of the mission
5. Reconnoiter in support of plan development
6. Complete the plan and develop the OPORD
7. Issue OPORD
8. Supervise execution of OPORD

Post-conditions: Trainee understands higher commanders mission and intent; Trainee understands the threat and higher commanders CCIR; Trainee develops a plan for his unit that has taken account of specified, implied and critical tasks necessary to fulfill the higher headquarters mission; Trainee issues his mission order to his unit elements and controls it's execution; Trainee exercises command.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

<table>
<tr><td colspan="3">Real World (RW) Preconditions: Higher Headquarters has issued a mission type order</td><td colspan="3">Environment Evaluation</td></tr>
<tr><th>Tasks</th><th>Human Abilities</th><th>Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of Support to training</th></tr>
<tr><td>Receive the mission and conduct analysis of its contents</td><td><u>COGNITIVE:</u>
Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Visualization; Spatial Orientation; Selective Attention; Time Sharing;

<u>SENSORY:</u>
Near Vision; Auditory Attention

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity

<u>PHYSICAL:</u> None</td><td>– Higher headquarters mission and commanders intent
– See assess enemy situation
– See perform terrain analysis
– See determine own force potential combat power
– A means to develop a timeline and keep track of time available for planning</td><td><u>COGNITIVE:</u>
Written Comprehension; Deductive Reasoning; Inductive Reasoning; Visualization; Spatial Orientation

<u>SENSORY:</u>
Near Vision

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity

<u>PHYSICAL:</u>
None</td><td>– System scenario development tool allows for as much or as little information about the mission to be provided to the trainee.
– System provides the option of changing the amount of available time to complete the mission but does not have a timeline tool or representation</td><td>4 – Very Good
*3 – Good
2 – Fair
1 – Poor</td></tr>
<tr><td>Issue a warning order to unit to allow them to begin parallel planning</td><td><u>COGNITIVE:</u>
Oral Expression; Written Expression;

<u>SENSORY:</u>
Near Vision; Speech Clarity;

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity;

<u>PHYSICAL:</u></td><td>– Audience to issue order too
– Ability to develop a warning order
– Warning order format
– A means of transferring the information to the audience if other than verbally (e.g., mission command system).</td><td><u>COGNITIVE:</u>
None

<u>SENSORY:</u>
Near Vision

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity

<u>PHYSICAL:</u>
None</td><td>– Audience of artificially intelligent avatars that execute instructions
– A way to transmit the order
– No warning order functionality present in the game.</td><td>4 – Very Good
*3 – Good
2 – Fair
1 – Poor

**This item would be rated as Poor if tasks were not considered equally important. Not having a warning order to issue makes this task untrainable.</td></tr>
</table>

	None				
Make a tentative Plan that will be the basis for the OPORD	**COGNITIVE:** Written Comprehension; Written Expression; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Number Facility; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Selective Attention; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See develop a light infantry COA – See conduct mission analysis	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See develop a light infantry COA – See conduct mission analysis	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Initiate movement of unit elements so that they may be prepared the mission	**COGNITIVE:** Oral Expression; Written Expression; Problem Sensitivity; Spatial Orientation; **SENSORY:** Speech Clarity;	– Environment must provide the trainee the ability to initiate movement of his forces in preparation for plan execution prior to OPORD issuance (e.g., move	**COGNITIVE:** Written Expression; Problem Sensitivity; **SENSORY:** Near Vision **PSYCHOMOTOR:**	– Settings within the scenario allow the opposing force to move during planning but not friendly forces – No WARNO capability – Game acts as mission	4 – Very Good 3 – Good *2 – Fair 1 – Poor

	PSYCHOMOTOR: Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; **PHYSICAL:** Dynamic Strength; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	vehicles to staging point, conduct reconnaissance, conduct rehearsals) – Ability to develop Warning type orders – A means to transmit orders (e.g., mission command system, radio)	Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	command system	
Reconnoiter in support of plan development	– See Conduct Reconnaissance	– See Conduct Reconnaissance	– See Conduct Reconnaissance	– See Conduct Reconnaissance	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Complete the plan and develop the OPORD	**COGNITIVE:** Oral Comprehension; Written Expression; Deductive Reasoning; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Selective Attention; Time Sharing; **SENSORY:** Near Vision; Auditory Attention; Speech Recognition;	– See assess civil considerations – Outputs or pieces of necessary information from previous steps of the mission analysis and troop leading processes – Pieces of the operations order or plan that are to be combined together to make up the plan of action	**COGNITIVE:** Written Expression; Deductive Reasoning; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See assess civil considerations – Higher HQ OPORD and intelligence information	4 – Very Good 3 – Good *2 – Fair 1 – Poor

	PSYCHOMOTOR: Manual Dexterity; Finger Dexterity; **PHYSICAL:** None				
Issue OPORD	**COGNITIVE:** Oral Expression; Written Expression; **SENSORY:** Near Vision; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See issue infantry company or company-team operations order	**COGNITIVE:** Written Expression **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See issue infantry company or company-team operations order	4 – Very Good 3 – Good *2 – Fair 1 – Poor
Supervise execution of the OPORD	**COGNITIVE:** Oral Expression; Oral Comprehension; Written Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Selective Attention;	– Elements to command and a tactical scenario in which to control them. – Any mission command systems available and normally used in the act of commanding or controlling a tactical plan – Scenario providing representations of the higher commander, the enemy, the physical environment and the enemy.	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination	– AI Unit – Higher HQ – Game acts as mission command system during execution – Tactical scenario – Interaction through scripted messages, simulated radio traffic and FRAGO orders – FRAGO capability	*4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Time Sharing; **<u>SENSORY:</u>** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **<u>PSYCHOMOTOR:</u>** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination; **<u>PHYSICAL:</u>** Explosive Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	– The environment should provide a way for the trainee to interact with his subordinate elements, his higher headquarters and the enemy (i.e., communicate, signal, attack, etc.) – Environment should provide a means for the trainee a way to adjust his plan and issue new orders during the scenario as in real life (See issue a FRAGO)	**<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None		
Post-conditions: Trainee understands higher commanders mission and intent; Trainee understands the threat and higher commanders CCIR; Trainee develops a plan for his unit that has taken account of specified, implied and critical tasks necessary to fulfill the higher headquarters mission; Trainee issues his mission order to his unit elements and controls it’s execution; Trainee exercises command					

Score: Fair 1.75

Action Item: Assess Civil Considerations

Doctrine: FM 3-24, 3-34, 5-0

Preconditions:

1. Trainee is familiar with doctrinal description of assessment (FM 5-0)
   - Gather tools and assessment data.
   - Understand current and desired conditions.
   - Develop assessment measures and potential indicators.
   - Develop the collection plan.
   - Assign responsibilities for conducting analysis and generating recommendations.
   - Identify feedback mechanisms.
2. Trainee has knowledge and understanding about civil considerations: The influence of manmade infrastructure, civilian institutions, and attitudes and activities of the civilian leaders, populations, and organizations within an AO on the conduct of military operations (FM 6-0).
3. Trainee receives current information regarding important civil considerations in his area of operations.

Tasks:

1. Trainee develops or adopts an existing assessment mechanism to categorize civil considerations (e.g., SWEAT [sewage, water, electricity, academics, trash] or ASCOPE [areas, structures, capabilities, organizations, people, events])
2. Trainee gathers and processes all available information about the civil considerations in his AO.
3. Trainee assigns a quantitative or qualitative value to each piece of the assessment mechanism based on 1.
4. Trainee monitors status of the conditions on the ground and updates his assessment (repeat steps 1-3) as necessary.

Post-conditions: Trainee is familiar with the important civil considerations within his AO; Trainee has increased proficiency in assessing the impact of civil considerations on military operations.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Trainee is familiar with doctrinal description of assessment (FM 5-0); Trainee has knowledge and understanding about civil considerations; Trainee receives current information regarding important civil considerations in his AO.			**Environment Evaluation** No information concerning civil considerations within the AO is provided to the Trainee by the game or the scenarios violating this necessary precondition.		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Trainee develops or adopts an existing assessment mechanism to categorize civil considerations.	**COGNITIVE:** Written Expression; Oral Expression; Fluency of Ideas; Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity; Originality; Category Flexibility; Memorization **SENSORY:** Near vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Example assessment mechanism – Tools to develop an assessment mechanism (e.g., mission command systems, pens, paper, etc.) – Way to visualize assessment	**COGNITIVE:** Fluency of Ideas; Speed of Closure; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity; Originality; Category Flexibility; Memorization **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– None	4 – Very Good 3 – Good 2 – Fair *1 – Poor
Trainee gathers and processes all available information about the civil considerations in his AO.	**COGNITIVE:** Oral comprehension; Written comprehension; Inductive Reasoning; Problem Sensitivity; Information Ordering; Speed of Closure **SENSORY:** Near Vision	– Information about the civilian population, government and urban landscape. – Known friction points between civilian population and friendly forces – Known problems within the civilian	**COGNITIVE:** Written Comprehension; Inductive reasoning; Problem Sensitivity **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity;	– Scenario editor provides the ability to have as much or as little information about the population as desired. This information would come from the BN OPORD. – System does not provide any way to	*4 – Very Good 3 – Good 2 – Fair 1 – Poor

	PSYCHOMOTOR: Manual Dexterity; Finger Dexterity **PHYSICAL:** None	population (e.g., fighting over oil rights) – Tools to annotate, arrange or depict information for analysis (e.g., mission command systems, acetate, map, alcohol pens, written order, paper, pencil, computer screens)	Finger Dexterity **PHYSICAL:** None	develop or annotate an assessment mechanism	
Trainee assigns a quantitative or qualitative value to each piece of the assessment mechanism based on 1.	**COGNITIVE:** Mathematical Reasoning; Number Facility; Inductive Reasoning; Deductive Reasoning **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Tools to mark or annotate the assessment mechanism – Assessment mechanism – Way to visualize the assessment mechanism (e.g., mission command system)	**COGNITIVE:** None **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– None	4 – Very Good 3 – Good 2 – Fair *1 – Poor
Trainee monitors status of the conditions on the ground and updates his assessment (repeat steps 1-3) as necessary.	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Speed of Closure; Memorization;	– Information about civil conditions in the area of operations that stimulate the use of an assessment mechanism or impact ongoing operations that the trainee must react to.	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Speed of Closure; Memorization	– None	4 – Very Good 3 – Good 2 – Fair *1 – Poor

	SENSORY: Peripheral Vision; Depth Perception; Far Vision; Near Vision; Speech Recognition; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Mission command system if used and available	**SENSORY:** Near Vision **PSYCHOMOTOR:** None **PHYSICAL:** None		
Post-conditions: Trainee is familiar with the important civil considerations within his AO; Trainee has increased proficiency in assessing the impact of civil considerations on military operations.					

Score: Good 3.28

Action Item: Integrate fundamentals and techniques of the offense into a COA

Doctrine: FM 3-21.10, 5-0

Preconditions: Trainee has understands the fundamentals of offensive operations (Surprise, Concentration, Audacity, Tempo, Flexibility); Trainee has been issued a mission order that directs his element to conduct an offensive operation; Trainee is familiar with the techniques of offensive operations (Movement to Contact, Attack, Exploitation, Pursuit)

Task: Develop an offensive COA

1. Identify the necessary offensive technique for the specified mission (Movement to Contact, Attack, Exploitation, Pursuit)
2. Analyze relative combat power (strengths and weaknesses)
3. Generate options that incorporate the fundamentals of offensive operations and offensive technique
4. Array the forces available
5. Develop an offensive concept of the operation
6. Assign responsibilities
7. Prepare a COA statement and sketch

Post-conditions: COA is developed that incorporates the fundamentals of the offense appropriately and meets the criteria of being suitable, acceptable, feasible, distinguishable and complete.

DEFINITION OF SCALE

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3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Trainee has understands the fundamentals of offensive operations (Surprise, Concentration, Audacity, Tempo, Flexibility); Trainee is familiar with the techniques of offensive operations (Movement to Contact, Attack, Exploitation, Pursuit); Trainee has been issued a mission order that directs his element to conduct an offensive operation.			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Limit of Support to Training**
Identify the necessary offensive technique for the specified mission	**<u>COGNITIVE:</u>** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Speed of Closure; Memorization; **<u>SENSORY:</u>** Near Vision; Speech Recognition **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** None	– Operations order from the higher headquarters that informs the trainee about the higher headquarters mission and what tasks his unit is responsible for. – See analyze enemy situation – See perform terrain analysis – See conduct mission analysis	**<u>COGNITIVE:</u>** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Speed of Closure **<u>SENSORY:</u>** Near Vision **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** None	– Higher HQ OPORD – See assess enemy situation – See perform terrain analysis – See conduct mission analysis	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Analyze own relative combat power (strengths, weaknesses)	**<u>COGNITIVE:</u>** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Visualization; Speed of Closure;	– See determine own force potential combat power	**<u>COGNITIVE:</u>** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Visualization; Speed of Closure;	– See determine own force potential combat power	*4 – Very Good 3 – Good 2 – Fair 1 – Poor

	SENSORY: Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		**SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Generate options that incorporate the fundamentals of offensive operations and offensive technique	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Higher commanders intent and desired endstate – See perform terrain analysis – See assess enemy situation – See conduct reconnaissance – See conduct mission analysis	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor – See perform terrain analysis – See assess enemy situation – See conduct reconnaissance – See conduct mission analysis	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Array the forces available	**COGNITIVE:** Deductive Reasoning; Information Ordering; Visualization; Spatial Orientation; Memorization;	– See determine own force potential combat power – See develop a light infantry course of action – See conduct mission	**COGNITIVE:** Deductive Reasoning; Information Ordering; Visualization; Spatial Orientation; Memorization;	– See determine own force potential combat power – See develop a light infantry course of action – See conduct mission	4 – Very Good *3 – Good 2 – Fair 1 – Poor

	SENSORY: Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	analysis	**SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	analysis	
Develop an offensive concept of operations	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Information Ordering; Visualization; Problem Sensitivity; Memorization **SENSORY:** Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– See develop a light infantry course of action – See conduct reconnaissance – See conduct mission analysis – See assess civil considerations	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Information Ordering; Visualization; Problem Sensitivity; Memorization **SENSORY:** Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– See develop a light infantry course of action – See conduct reconnaissance – See conduct mission analysis – See assess civil considerations	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Assign responsibilities	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Speed of Closure; Perceptual Speed; Memorization **SENSORY:** Near Vision; Speech Clarity	– A way to verbally, orally or pictorially represent the responsibilities for tasks/missions to subordinate units/elements	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Speed of Closure; Perceptual Speed; Memorization **SENSORY:** Near Vision; Speech Clarity	– Order process where tasks are assigned to units	*4 – Very Good 3 – Good 2 – Fair 1 – Poor

	PSYCHOMOTOR: Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		**PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Prepare a COA statement and sketch	**COGNITIVE:** Written Expression; Information Ordering **SENSORY:** Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See develop a light infantry COA	**COGNITIVE:** Written Expression; Information Ordering **SENSORY:** Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See develop a light infantry COA	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Post-conditions: COA is developed that incorporates the fundamentals of the offense appropriately and meets the criteria of being suitable, acceptable, feasible, distinguishable and complete.					

Score: Good 3.00

Action Item: Conduct Mission Analysis

Doctrine: FM 3-21.10, 5-0

Preconditions: Trainee has received the mission; Trainee has issued a warning order (WARNO)

Tasks:

1. Analyze Mission
   a. Purpose
   b. Tasks
   c. Constraints
   d. Develop a Restated Mission
2. Conduct Terrain Analysis (Separate Evaluation)
3. Analyze Enemy Situation (Separate Evaluation)
4. Develop Commander Critical Information Requirements (CCIR)
5. Conduct Troop Analysis (Separate Evaluation)
6. Conduct analysis of available time
7. Analyze Civil Considerations (Separate Evaluation)
8. Conduct a risk assessment
9. Identify tentative decisive points based on conclusions and intuition
10. Develop a commander's intent
11. Issue a warning order

Post-conditions: Trainee unit's mission is known; Trainee comprehends the current situation ; Trainee has a conceptual understanding of how his unit will accomplish the mission; Trainee has identified potential risks of the operation.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Trainee has received the mission; Trainee has Issued a warning order (WARNO)			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Analyze the Mission	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Trainee must have been given a mission with implied, specified and critical tasks. The mission should have a timeline for completion. – The information provided to the trainee should answer the questions of who, what, where, when and why or the trainee should be able to process the given information to draw inferences that answer the questions – Trainee must be able to review the higher commanders order and parse information that he deems necessary. The environment should support the trainee in parsing information, drafting plans and identifying tasks his unit must accomplish – Environment should support the	**COGNITIVE:** Written Comprehension; Inductive Reasoning; Deductive Reasoning; Problem Sensitivity; Visualization; Speed of Closure; **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor and higher HQ order – Trainee not able to draft a mission statement	*4 – Very Good 3 – Good 2 – Fair 1 – Poor

		development and drafting of a mission statement			
Conduct Terrain Analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	See perform terrain analysis	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Analyze Enemy Situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	See analyze enemy situation	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Develop Commander Critical Information Requirements (CCIR)	**COGNITIVE:** Oral Expression; Oral Comprehension; Written Comprehension; Written Expression; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Clarity; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Trainee must be provided with materials (i.e., intelligence materials) that provide or support the inference of CCIR. – Tools to author, refine and transmit CCIR's to trainee's unit via voice or digital means. – A way to denote and link CCIR to the operational plan.	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario may provide higher headquarters CCIR if included in the OPORD. – No ability for the trainee to develop or denote CCIR for his unit or transmit CCIR as part of the COA/OPORD for execution.	4 – Very Good 3 – Good *2 – Fair 1 – Poor

Conduct Troop Analysis	See determine own force potential combat power	See determine own force potential combat power	See determine own force potential combat power	See determine own force potential combat power	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Conduct analysis of available time	**COGNITIVE:** Written Comprehension; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Number Facility; Speed of Closure; Selective Attention; Time Sharing; **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** None **PHYSICAL:** None	– Time context i.e., the present time or a scripted future or past time. – Trainee must have a starting time from which to plan from and against. – Orders must specify a time or time frame for mission accomplishment so that the trainee may execute this analysis. – A way to develop and transmit a timeline for mission accomplishment	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Number Facility; Time Sharing **SENSORY:** Near Vision; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Game allows for play to go from 30 min to 4:30 in 30 min increments – Time my begin during planning phase if selected – Scenario may provide information relating to when mission must start and be completed by. – Time is annotated on the CDR POV screen during execution of mission – Trainee unable to develop, display or transmit a timeline	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Analyze Civil Considerations	See assess civil considerations	See assess civil considerations	See assess civil considerations	See assess civil considerations	4 – Very Good 3 – Good *2 – Fair 1 – Poor
Conduct a risk assessment	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial	– See analyze enemy situation – See perform terrain analysis – See determine own force potential combat power – Environment must	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Speed of Closure; Perceptual	– No risk management plan, template or functionality is explicitly included in the game. All risk management functionality is implicitly included in	4 – Very Good *3 – Good 2 – Fair 1 – Poor

	Orientation; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	support the development of a risk management plan for the unit that identifies risks and controls	Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	other activities.	
Identify tentative decisive points based on conclusions and intuition	**COGNITIVE:** Oral Comprehension; Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Speed of Closure; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario that contains information that supports the trainee in the identification and development of decisive points that define how, where, or when the unit will accomplish its purpose. – Information from intelligences sources about the enemy and the higher commanders intent and vision – A way to denote or annotate decisive points in the order or on the COA sketch.	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Scenario editor provides ability to include pertinent information to OPORD – Intelligence materials may be developed and added to background and OPORD	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Develop a commanders intent	**COGNITIVE:** Written Expression;	– Outputs from previously identified	**COGNITIVE:** Written Expression;	– See analyze enemy situation	4 – Very Good *3 – Good

	Deductive Reasoning; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	steps – See analyze enemy situation – See perform terrain analysis – See determine own force potential combat power – See conduct reconnaissance – See develop a light infantry company course of action –	Deductive Reasoning; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Memorization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See perform terrain analysis – See determine own force potential combat power – See conduct reconnaissance – See develop a light infantry company course of action – COA/Order development process does not include the ability to express the CI.	2 – Fair 1 – Poor **Math: this step includes evaluation of each step for this subtask as well as all of the steps from all of the previous subtasks. If subtask was roll up of others then just the score from the umbrella subtask was used to eliminate double and triple counting. This score 3.25
Issue a warning order	**COGNITIVE:** Written Comprehension, Oral Expression, Written Expression; **SENSORY:** Near Vision; Speech Clarity **PSYCHOMOTOR:** Arm Hand Steadiness; Manual Dexterity; Finger Dexterity; **PHYSICAL:** Extent Flexibility	– Correct order format – Means to deliver the WO – Information from previous steps	**COGNITIVE:** None **SENSORY:** None **PSYCHOMOTOR:** None **PHYSICAL:** None	– No warning order functionality exists within FSC	4 – Very Good *3 – Good 2 – Fair 1 – Poor **Step would have been rated as poor if affordances not treated equally.
Post-conditions: Trainee unit's mission is known; Trainee comprehends the current situation; Trainee has a conceptual understanding of how his unit will accomplish the mission; Trainee has identified potential risks of the operation					

Score: Good 3.30

Action Item: Plan Breaching Operations

Doctrine: FM 3-21.10, 5-0

Preconditions: Mission order received directing unit to conduct breaching operations as part of or as their mission; Task organization for mission is provided; Breaching assets are allocated and provided to trainee.

Task: Trainee applies the five tenants of planning for breach operations: intelligence, fundamentals, organization, mass and synchronization.

1. Trainee evaluates the enemy situation and applies this information to his plan
2. Trainee considers the terrain and how it supports breach execution (approach routes; primary/alternate breach point; SBF position; fire support positioning)
3. Trainee organizes his assets (i.e., support, breach and assault forces and security element)
4. Trainee applies the fundamentals of breaching (SOSRA) suppress, obscure, secure, reduce, and assault in planning
5. Trainee synchronizes the positioning and effects of all aspects of breaching through the use of control measures
6. Trainee authors the plan.

Post-conditions: Synchronized breaching plan developed.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Mission order received directing unit conduct breaching operations as part of or as their mission; Task organization provided; Breaching assets allocated			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Limit of Support to Training**
Trainee evaluates the enemy situation and applies this information to his plan.	– See analyze enemy situation	– See analyze enemy situation	– See analyze enemy situation	– See analyze enemy situation	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Trainee considers the terrain and how it supports breach execution (approach routes; primary/alternate breach point; SBF position; Fire support positioning)	– See perform terrain analysis	– See perform terrain analysis	– See perform terrain analysis	– See perform terrain analysis	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee organizes his assets recognizing strengths and weaknesses (i.e., Support, Breach and Assault Forces & Security element)	– See determine own force potential combat power	– See determine own force potential combat power	– See determine own force potential combat power	– See determine own force potential combat power	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Trainee applies the fundamentals of breaching (SOSRA) suppress, obscure, secure, reduce, and assault in planning	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Memorization **SENSORY:** Near Vision; Visual	– Tools that allow the trainee to develop and manipulate a breaching plan (e.g., alcohol pens, mission command systems) – See develop a light infantry company COA	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; **SENSORY:** Near Vision; Visual Color Discrimination **PSYCHOMOTOR:**	– Game order planning screen allows trainee to build plan and adjust as desired	4 – Very Good *3 – Good 2 – Fair 1 – Poor

	Color Discrimination **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** None		Manual Dexterity; Finger Dexterity **<u>PHYSICAL:</u>** None		
Trainee synchronizes the positioning and effects of all aspects of breaching through the use of control measures	**<u>COGNITIVE:</u>** Deductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Memorization **<u>SENSORY:</u>** Near Vision; **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	– A method and tools (e.g., mission command system) for developing a plan – Doctrinal graphical symbology (e.g., control measures) – See develop a light infantry company COA – A method to conduct time and battlespace synchronization during planning	**<u>COGNITIVE:</u>** Deductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; **<u>SENSORY:</u>** Near Vision; **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	– OPORD planning screen allows trainee to build a plan using phases and other limited doctrinal control measures – Phase lines, breach symbol – See develop a light infantry COA	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Trainee authors the plan	**<u>COGNITIVE:</u>** Oral Expression; Written Expression; **<u>SENSORY:</u>** Near Vision, Visual Color Discrimination **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	– Tools to draft/build the plan (e.g., maps, acetate, alcohol pens, mission command system) – A way to depict the plan so others may see and understand it (e.g., butcher boards, mission command systems)	**<u>COGNITIVE:</u>** Written Expression; **<u>SENSORY:</u>** Near Vision, Visual Color Discrimination **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	– Game provides functionality to develop an order that includes breaching information	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Post-conditions: Synchronized plan for breaching an obstacle exists					

Score: Very Good 3.66

Action Item: Apply the fundamentals of conducting a movement to contact (MTC)

Doctrine: FM 3-21.10, 3-90

Preconditions: Mission order received directing unit to conduct offensive operations to gain intelligence or contact with an enemy force; Trainee is knowledgeable of doctrine about how to conduct a MTC and the fundamentals of conducting a MTC; Trainee is proficient in the development of MTC COA

Tasks:

1. Develop a plan/COA that includes the following fundamentals:
    a. Focus all reconnaissance efforts on finding the enemy
    b. Make contact with the enemy using the smallest element possible (visual contact preferred)
    c. Avoid decisive engagement with the main body until conditions are favorable
    d. Maintain freedom of maneuver and mutual support between and within unit elements
    e. Maintain contact with the enemy
2. Command and control the execution of the plan

Post-conditions: Contact made with the enemy on favorable terms; Unit achieves tactical/operational objectives

DEFINITION OF SCALE

<u>4–Very Good</u>—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
<u>3–Good</u>—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
<u>2–Fair</u>—the ITE contains some (25–49%) of the affordances determined during the initial analysis
<u>1–Poor</u>—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

<table>
<tr><td colspan="3">Real World (RW) Preconditions: Mission order received directing unit to conduct offensive operations to gain intelligence or contact with an enemy force; Trainee is knowledgeable of doctrine about how to conduct a MTC and the fundamentals of conducting a MTC; Trainee is proficient in the development of MTC COA</td><td colspan="3">Environment Evaluation</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of Support to Training</th></tr>
<tr><td>Develop a course of action that includes:
– Focus all reconnaissance efforts on finding the enemy
– Make contact with the enemy using the smallest element possible (visual contact preferred)
– Avoid decisive engagement with the main body until conditions are favorable
– Maintain freedom of maneuver and mutual support between and within unit elements
– Maintain contact with the enemy</td><td><u>COGNITIVE:</u>
Oral Comprehension; Written Comprehension; Deductive Reasoning; Fluency of Ideas; Information Ordering; Mathematical Reasoning; Speed of Closure; Memorization; Selective Attention
<u>SENSORY:</u>
Near Vision;
<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity;
<u>PHYSICAL:</u>
None</td><td>– Higher Commanders intent and desired operational endstate
– See determine own force potential combat power
– See perform terrain analysis
– See assess enemy situation
– See develop a light infantry course of action
– Intelligent Soldiers that are knowledgeable of MTC fundamentals and doctrine</td><td><u>COGNITIVE:</u>
Written Comprehension; Deductive Reasoning; Fluency of Ideas; Information Ordering; Memorization;
<u>SENSORY:</u>
Near Vision;
<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity;
<u>PHYSICAL:</u>
None</td><td>– Scenario editor allows for the inclusion of commanders intent and desired endstate.
– Planning tab includes an orders development capability that allows the trainee to build an Order.
– Trainee does not have any control over the movement of the individual avatars</td><td>*4 – Very Good
3 – Good
2 – Fair
1 – Poor</td></tr>
<tr><td>Command and Control the execution of the plan</td><td><u>COGNITIVE:</u>
Oral Expression; Oral Comprehension; Written</td><td>– Intelligent Soldiers that are knowledgeable of MTC fundamentals</td><td><u>COGNITIVE:</u>
Oral Comprehension; Written Comprehension;</td><td>– Scenario representing environment, higher commander and own</td><td>*4 – Very Good
3 – Good
2 – Fair
1 – Poor</td></tr>
</table>

	Comprehension; Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Selective Attention; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Clarity; Speech Recognition; Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination;	and doctrine – Tactical scenario that provides a higher commander, enemy and physical environment. – Verbal or digital communication capability between the trainee, his unit elements and his higher headquarters. – Physical or visual interaction between the trainee, his subordinate elements, his higher headquarters and the enemy. – Environment should afford the trainee a way to adjust his plan and issue new orders during the scenario as in real life.	Deductive Reasoning; Fluency of Ideas; Inductive Reasoning; Information Ordering; Spatial Orientation; Memorization; Time Sharing; **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	unit elements and enemy – Limited scripted simulated radio communications – Limited simulated visual/physical contact with enemy, own troops and higher headquarters – FRAGO capability is present	** This item would be rated as Fair due to the limited interaction between the game entities and the trainee if affordances were not all considered equal

	<u>PHYSICAL:</u> Explosive Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium				
Issue a Fragmentary Order [FRAGO] (as needed)	See issue a fragmentary order	See issue a fragmentary order	See issue a fragmentary order	See issue a fragmentary order	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Post-conditions: Contact made with the enemy on favorable terms; Unit achieves tactical/operational objectives					

Score: Good 3.00

Action Item: Integrate Fire Support Into Urban Operations

Doctrine: FM 3-21.10

Preconditions: Mission order provided to trainee; Fire support assets available to the trainee are specified; Trainee is knowledgeable on urban operations (UO) doctrine, the current ROE for use of indirect fire/mortars and the enemy situation.

Tasks:

1. Process information on the capabilities of own unit and general fire support assets available
2. Process information concerning the enemy's capabilities and possible use of urban terrain
3. Process information concerning the ROE and any civil considerations affected by the use of indirect fire/mortars
4. Develop a fire support plan for the mission

Post-conditions: Fire Support plan is developed; Fire Support Coordination and Control measures are known by the unit; Fire support is integrated into the movement and maneuver plan.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Mission order provided to trainee; Fire support assets available to the trainee are specified; Trainee is knowledgeable on Urban Operations (UO) doctrine, the current ROE for use of indirect fire/mortars and the enemy situation			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Limit of Support to Training**
Process information on the capabilities of own unit and general fire support assets available	**COGNITIVE:** Written Comprehension; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Speed of Closure **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** None **PHYSICAL:** None	– See assessment of determine own force potential combat power. – Information about any additional fire support assets allocated for the unit's use during an operation (e.g., size, number, etc.)	**COGNITIVE:** Written Comprehension; Inductive Reasoning; Problem Sensitivity; Speed of Closure **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity, Finger Dexterity **PHYSICAL:** None	– Editable scenario that may provide detail as necessary – Default force structure that includes mortar assets	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Process information concerning the enemy's capabilities and possible use of urban terrain	**COGNITIVE:** Written Comprehension; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Memorization **SENSORY:** Near Vision; Speech Recognition	– See analyze enemy situation – See perform terrain analysis	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; **SENSORY:** Near Vision **PSYCHOMOTOR:** None	– See analyze enemy situation – See perform terrain analysis	4 – Very Good *3 – Good 2 – Fair 1 – Poor

	PSYCHOMOTOR: None **PHYSICAL:** None		**PHYSICAL:** None		
Process information concerning the ROE and any civil considerations affected by the use of indirect fire/mortars	**COGNITIVE:** Written Comprehension; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Memorization **SENSORY:** Near Vision; Speech Recognition **PSYCHOMOTOR:** None **PHYSICAL:** None	– ROE considerations dealing with indirect fires/mortars – See assess civil considerations	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** None **PHYSICAL:** None	– Adjustable ROE setting and information – See assess civil considerations	4 – Very Good 3 – Good *2 – Fair 1 – Poor
Develop a fire support plan for the mission that considers the use of high explosive, smoke and illumination ordinance and targets that support the execution of the tactical plan	**COGNITIVE:** Written Expression; Deductive Reasoning; Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Spatial Orientation; Speed of Closure; Memorization; **SENSORY:** Near Vision	– See assessment for develop a light infantry COA. – See perform terrain analysis – Means to graphically display fire control measures on the area of operations – Necessary doctrinal symbology – A means to coordinate fire support with	**COGNITIVE:** Written Expression; Deductive Reasoning; Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Speed of Closure; **SENSORY:** Near Vision **PSYCHOMOTOR:**	– See develop a light infantry COA – See perform terrain analysis – Ability to place targets and task mortars – TRP and Illumination symbols only	4 – Very Good *3 – Good 2 – Fair 1 – Poor

	PSYCHOMOTOR: Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	outside sources if required	Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Post-conditions: Fire Support plan is developed; Fire Support Coordination and Control measures are known by the unit; Fire support is integrated into the movement and maneuver plan					

Score: Good 3.00

Action Item(s): Issue Infantry Company or Company-Team Operations Order (OPORD)

Doctrine: FM 5-0, 3-21.10

Preconditions: Trainee has received an operations order from his/her higher headquarters with supporting materials (e.g., graphics, enemy situational templates); Trainee has conducted a preliminary mission analysis on the higher commanders order; Trainee has developed a 5-paragraph operations order to provide direction to a unit for the execution of a mission.

Task:

1. Issue the OPORD Verbally

2. Issue the OPORD Digitally

Post-conditions: New information has been transmitted from commander to unit; Unit elements acknowledge receipt of OPORD.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

<table>
<tr><td colspan="3">Real World (RW) Preconditions: Trainee has received an operations order from his/her higher headquarters with supporting materials (e.g., graphics, enemy situational templates); Trainee has conducted a preliminary mission analysis on the higher commanders order; rainee has developed a 5-paragraph operations order to provide direction to a unit for the execution of a mission.</td><td colspan="3">Environment Evaluation
OPORD developed by users of FSC is a matrix style order that does not follow doctrinal guidelines.</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of Support to training</th></tr>
<tr><td>Issue OPORD verbally
– Read OPORD
– Verbally transmit information</td><td><u>COGNITIVE:</u>
Written Comprehension; Oral Expression

<u>SENSORY:</u>
Near Vision; Speech Clarity

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity

<u>PHYSICAL:</u>
None</td><td>– 5-paragraph OPORD
– A means to amplify the voice so that transmission of the OPORD may occur if the audience is not within hearing range (e.g., radio)</td><td><u>COGNITIVE:</u>
None

<u>SENSORY:</u>
Near Vision;

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity

<u>PHYSICAL:</u>
None</td><td>– Simulated unit
– No means to verbally transmit information
– Matrix order</td><td>4 – Very Good
*3 – Good
2 – Fair
1 – Poor

**Task would be rated Poor if task elements were not treated equally.</td></tr>
<tr><td>Issue OPORD digitally</td><td><u>COGNITIVE:</u>
Deductive Reasoning;

<u>SENSORY:</u>
Near Vision

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity

<u>PHYSICAL:</u>
None</td><td>– 5-paragraph OPORD
– A way to digitally deliver or transmit the order (e.g., mission command system)</td><td><u>COGNITIVE:</u>
Deductive Reasoning

<u>SENSORY:</u>
Near Vision

<u>PSYCHOMOTOR:</u>
Manual Dexterity; Finger Dexterity

<u>PHYSICAL:</u>
None</td><td>– Simulated digital transmission of OPORD
– Simulated unit
– Matrix order</td><td>4 – Very Good
*3 – Good
2 – Fair
1 – Poor</td></tr>
<tr><td colspan="6">Post-conditions: New information has been transmitted from commander to unit; Unit elements acknowledge receipt of OPORD.</td></tr>
</table>

Score: Fair 2.50

Action Item: Conduct Reconnaissance

Doctrine: FM 5-0, 3-21.10

Preconditions: Trainee receives mission orders (WARNO, FRAGO OPORD) from a higher headquarters; Trainee is proficient with the troop leading procedures and METT-TC; Trainee has executed steps 1–4 of the TLP; Trainee is familiar with mission analysis.

Task: Reconnoiter

1. Trainee identifies areas of his tentative plan where reconnaissance is necessary to complete the plan.
2. Trainee identifies/derives information requirements (IR)
3. Trainee determines the type of reconnaissance to conduct based on METT-TC considerations and IRs.
   a. Physical (i.e., Key leader reconnaissance of the ground)
   b. Materials based reconnaissance (i.e., review of materials provided to him by his higher headquarters [e.g., aerial photos, map intelligence])
4. Reconnaissance conducted:
   a. Personally by leader
   b. By tasked elements within unit based on IRs.
5. If trainee assigned elements to conduct reconnaissance, the trainee receives back brief on the results of the reconnaissance so that he can complete his plan.
6. If conducted as part of ongoing operations, trainee repeats steps 3-5 as necessary to maintain a current assessment.

Post-conditions: Reconnaissance of terrain conducted; Reconnaissance of enemy conducted; Information requirements developed and distributed

DEFINITION OF SCALE

<u>4–Very Good</u>—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
<u>3–Good</u>—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
<u>2–Fair</u>—the ITE contains some (25–49%) of the affordances determined during the initial analysis
<u>1–Poor</u>—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Trainee receives mission orders (WARNO, FRAGO OPORD) from a higher headquarters; Trainee is proficient with the troop leading procedures and METT-TC; Trainee has already executed steps 1-4 of the TLP; Trainee is familiar with mission analysis.			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Trainee identifies areas of his tentative plan where reconnaissance is necessary to complete the plan.	**<u>COGNITIVE:</u>** Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Visualization; Perceptual Speed; Time Sharing; Memorization **<u>SENSORY:</u>** Near Vision; **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	– See Analyze Enemy Situation – See Perform Terrain Analysis – See Develop a Light Infantry COA – A tentative plan	**<u>COGNITIVE:</u>** Inductive Reasoning; Problem Sensitivity; Visualization; Memorization **<u>SENSORY:</u>** Near Vision; **<u>PSYCHOMOTOR:</u>** Manual Dexterity; Finger Dexterity; **<u>PHYSICAL:</u>** None	– See Analyze Enemy Situation – See Perform Terrain Analysis – See Develop a Light Infantry COA – No development of a reconnaissance plan is possible – No initial plans are developed needing reconnaissance	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Trainee identifies and derives his information requirements (IR)	**<u>COGNITIVE:</u>** Written Expression; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Time Sharing; **<u>SENSORY:</u>** Near Vision; **<u>PSYCHOMOTOR:</u>**	– Higher headquarters information requirements (IR) and commanders critical information requirements (CCIR) – See Analyze Enemy Situation – See Perform Terrain Analysis – A way to capture IRs in words or pictures	**<u>COGNITIVE:</u>** Written Expression; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Time Sharing; **<u>SENSORY:</u>** Near Vision; **<u>PSYCHOMOTOR:</u>**	– Scenario can included IR's and CCIRs from higher commander – See Analyze Enemy Situation – See Perform Terrain Analysis – No capability to capture IRs in pictures or words	4 – Very Good *3 – Good 2 – Fair 1 – Poor

	Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Trainee determines the type of reconnaissance to conduct (e.g., map or LDR Recon) based on METT-TC considerations and IRs	**COGNITIVE:** Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Speed of Closure; Time Sharing **SENSORY:** Near Vision; **PSYCHOMOTOR:** None **PHYSICAL:** None	– See Analyze Enemy Situation – See Perform Terrain Analysis – The ability to conduct all forms of reconnaissance	**COGNITIVE:** Inductive Reasoning **SENSORY:** Near Vision; **PSYCHOMOTOR:** None **PHYSICAL:** None	– System limited to map reconnaissance only – See Analyze Enemy Situation – See Perform Terrain Analysis	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Physical reconnaissance	**COGNITIVE:** Problem Sensitivity; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; Time Sharing **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Recognition;	– Environment must provide the physical and sensory information (e.g., trees, brush etc.) necessary to replicate the high physical fidelity of conducting reconnaissance. Types of physical actions may include walking, crawling, using optics, navigation with map/GPS etc. – Visual and sensory information of enemy activity for trainee to	**COGNITIVE:** Problem Sensitivity; **SENSORY:** Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– System does not support physical reconnaissance	4 – Very Good 3 – Good 2 – Fair *1 – Poor

	Hearing Sensitivity; Sound Localization; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Response Orientation; Rate Control; Multilimb Coordination; Reaction Time; Speed of Limb Movement; **PHYSICAL:** Static Strength; Explosive Strength Dynamic Strength; Trunk Strength; Stamina; Extent Flexibility; Gross Body Coordination; Gross Body Equilibrium	see and comprehend – Replication of friendly and enemy equipment and personnel – Replication of operational terrain and weather – See perform terrain analysis – See analyze civil considerations			
Map Reconnaissance	**COGNITIVE:** Written Comprehension; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; Perceptual Speed; **SENSORY:** Near Vision;	– Computer automation assets (i.e., mission command system) if used for command and control – See perform terrain analysis – See assess enemy situation	**COGNITIVE:** Written Comprehension; Inductive Reasoning; Problem Sensitivity; Visualization; Spatial Orientation; Flexibility of Closure; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:**	– Scenario editor allows for simple map views and simulated visual intelligence products to be provided to the trainee as part of the Higher headquarters OPORD – Game acts as the default automation asset	4 – Very Good *3 – Good 2 – Fair 1 – Poor

	PSYCHOMOTOR: Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
If trainee assigned elements to conduct reconnaissance, the trainee receives back brief on the results of the reconnaissance so that he can complete his plan	**COGNITIVE:** Oral Comprehension; Written Comprehension; Inductive Reasoning; Problem Sensitivity; Information Ordering; Visualization; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Near Vision; Speech Recognition; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Visual products associated with the reconnaissance conducted e.g., maps, sketches, and photos taken. – Computer automation to assist visualization (e.g., mission command system) – Verbal reconstruction of reconnaissance conducted	**COGNITIVE:** Oral Comprehension; Inductive Reasoning; Problem Sensitivity; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; **SENSORY:** Near Vision; Speech Recognition; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Reports from elements tasked to execute non-reconnaissance type missions that the trainee hopes will provide more information about the enemy	4 – Very Good 3 – Good *2 – Fair 1 – Poor
If conducted as part of ongoing operations, trainee repeats steps 3-5 as necessary to maintain a current assessment.					
Post-conditions: Reconnaissance of terrain conducted; Reconnaissance of enemy conducted; Information requirements developed and distributed					

Score: Good 3.00

Action Item: Develop a Light Infantry Course of Action

Doctrine: FM 3-21.10; 5-0

Preconditions: Mission order has been issued and received by the trainee.

Task: Develop a COA

1. Analyze relative combat power (strengths and weaknesses)
2. Generate Options about how to successfully execute the mission
3. Array Forces available based on the options developed to determine troops to task
4. Develop a concept of operations that describes how the leader envisions the operation unfolding, from its start to its conclusion or end state.
5. Assign responsibilities for tasks to subordinate elements by name
6. Prepare a COA statement and sketch that describes the operation

Post-conditions: COA meets the criteria of being suitable, feasible, acceptable, distinguishable, complete.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Mission order has been issued and received by the trainee.			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Analyze relative combat power (strengths, weaknesses)	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See Determine own force potential combat power – See Perform Terrain Analysis – See Assess Enemy Situation – See Assess Civil Considerations	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See Determine own force potential combat power – See Perform Terrain Analysis – See Assess Enemy Situation – See Assess Civil Considerations	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Generate Options about how to successfully execute the mission	**COGNITIVE:** Fluency of Ideas; Originality; Problem Sensitivity; Information Ordering; Mathematical Reasoning; Visualization; Speed of Closure; Perceptual Speed; Memorization; **SENSORY:** Near Vision **PSYCHOMOTOR:**	– See Determine own force potential combat power – See Assess Enemy Situation – See Perform Terrain Analysis – See Assess Civil Considerations – Higher commanders intent, desired endstate, and critical information	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:**	– See Determine own force potential combat power – See Assess Enemy Situation – See Perform Terrain Analysis – See Assess Civil Considerations – Scenario editor that allows information to be added or deleted from OPORD	4 – Very Good *3 – Good 2 – Fair 1 – Poor

	Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	requirements	Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Array Forces available based on the options developed to determine troops to task	**COGNITIVE:** Information Ordering; Spatial Orientation; Perceptual Speed; Memorization; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See Determine own force potential combat power – Tools (a way) that allow the trainee to arrange/rearrange and assign unit elements to meet desired objectives	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– See Determine own force potential combat power – Game allows trainee to assign specific tasks to elements based on their assets and capabilities	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Develop a concept of operations that describes how the leader envisions the operation unfolding, from its start to its conclusion or end state	**COGNITIVE:** Information Ordering; Visualization; Memorization **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:**	– Tools to develop a framework that allows the trainee to describe the relationships between activities, events, and tasks, and explains how the tasks will lead to accomplishing the mission. – Tools for the trainee to use to physically depict or sketch out	**COGNITIVE:** Written Comprehension; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure **SENSORY:** Near Vision; **PSYCHOMOTOR:**	– As part of the planning screen under order development the trainee builds (sketch out) an OPORD as a COA using symbols representing tasks that may be assigned to units by dragging them into the unit's box.	4 – Very Good *3 – Good 2 – Fair 1 – Poor

	None	their plan in text or pictorial form	Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Assign responsibilities for tasks to subordinate elements by name	**COGNITIVE:** Deductive Reasoning; Problem Sensitivity; Speed of Closure; Perceptual Speed; Memorization **SENSORY:** Near Vision; Speech Clarity **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– A way to assign or annotate specific tasks or missions to subordinate units by name in writing (words), verbally or using pictures or symbols.	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	– Order development screen that allows trainee to assign tasks to units by dragging them into the unit's box	*4 – Very Good 3 – Good 2 – Fair 1 – Poor
Prepare a COA statement and sketch that describes the operation	**COGNITIVE:** Written Expression; Information Ordering **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity; **PHYSICAL:** None	Tools to build and display a COA statement and sketch that contains: – A decisive point, and what makes it decisive – A form of maneuver or type of defensive operation – Tasks and purposes of the decisive, shaping, and sustaining operations	**COGNITIVE:** Written Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Mathematical Reasoning; Speed of Closure; **SENSORY:** Near Vision; **PSYCHOMOTOR:**	– Game only provides an orders development screen where the OPORD is entered in graphical form.	4 – Very Good 3 – Good 2 – Fair *1 – Poor

		– Reserve planning priorities – Purposes of critical WFF elements – The desired end state – A statement that describes the COA	Manual Dexterity; Finger Dexterity; **PHYSICAL:** None		
Post-conditions: COA meets the criteria of being suitable, feasible, acceptable, distinguishable, complete					

Score: Good 3.30

Action Item: Issue a Fragmentary Order (FRAGO)

Doctrine: FM 5-0, 3-21.10

Preconditions: Trainee has developed and issued a plan (WARNO, OPORD) to his unit; Original plan requires modifications due to new tactical or operational conditions; Elements of order needing adjustment have been identified.

Task:

1. Develop a fragmentary order as a result of changes to the original plan
2. Issue FRAGO verbally
    a. Read FRAGO
    b. Verbally express information
3. Issue FRAGO as an overlay type order

Post-conditions: New information has been transmitted from commander to unit; Unit elements acknowledge receipt of FRAGO.

DEFINITION OF SCALE

4–Very Good—the ITE contains a significant portion (75-100%) of the affordances determined during the initial analysis
3–Good—the ITE contains a good portion (50-74%) of the affordances determined during the initial analysis
2–Fair—the ITE contains some (25–49%) of the affordances determined during the initial analysis
1–Poor—the ITE contains very few (0–24%) of the affordances determined during the initial analysis

Real World (RW) Preconditions: Trainee has developed and issued a plan (WARNO, OPORD) to his unit; Original plan requires modifications due to new tactical or operational conditions; Elements of order needing adjustment have been identified.			**Environment Evaluation**		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to training**
Develop/draft a 5 paragraph fragmentary order to provide direction to units in contact as a result of changes in battlefield conditions.	**COGNITIVE:** Originality; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Information that indicates that a change in the original order is necessary – 5 paragraph Fragmentary Order Format – A way to place necessary information into the FRAGO format (e.g., typed text or hand written)	**COGNITIVE:** Originality; Problem Sensitivity; Information Ordering; Visualization; Speed of Closure **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Reports of unit contact with the enemy – Reports of unit accomplishment of tasks – Doctrinal symbols representing tasks – Screen that contains task symbols and unit icon representations that allows tasks to be dragged and dropped onto units	4 – Very Good *3 – Good 2 – Fair 1 – Poor
Issue FRAGO verbally – Read FRAGO – Verbally Express information	**COGNITIVE:** Written Comprehension; Oral Expression **SENSORY:** Near Vision; Speech Clarity **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– FRAGO in a written form – A means to amplify the voice so that transmission of the FRAGO may occur if the audience is not within hearing range (e.g., radio) – Audience for receipt of order	**COGNITIVE:** None **SENSORY:** Near Vision; **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	– Simulated unit – No means to verbally transmit information	4 – Very Good *3 – Good 2 – Fair 1 – Poor ** This item would be rated as Poor if tasks were not considered equally important.
Issue FRAGO digitally	**COGNITIVE:**	– A way to digitally	**COGNITIVE:**	– Simulated digital	*4 – Very Good

	Information Ordering; Spatial Orientation; **SENSORY:** Depth Perception; Near Vision **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity **PHYSICAL:** Extent Flexibility	deliver or transmit the order (e.g., mission command system) – Audience to receive order	Written Comprehension; Oral Expression **SENSORY:** Near Vision **PSYCHOMOTOR:** Manual Dexterity; Finger Dexterity **PHYSICAL:** None	transmission of FRAGO information to unit – Simulated unit	3 – Good 2 – Fair 1 – Poor
Post-conditions: New information has been transmitted from commander to unit; Unit elements acknowledge receipt of FRAGO.					

APPENDIX G. ANALYSIS OF EST 2000

The following pages provide the analysis conducted on the EST 2000 Heavy Weapons simulator located at Fort Hunter Liggett, California.

Score: 4.43 Very Good

High Level Task: Engage targets with the MK19 IAW DA FORM 7518-R

Doctrine: DA FORM 7518-R; FM 3-22.27

Preconditions:

1. Trainees have received training and have passed the MK19 fundamental skills test (i.e., clearing the weapon, disassembly and assembly of the weapon, functions check, how to maintain the weapon, load the weapon, perform immediate actions and unload the weapon)

2. Trainees have received training on how to install, adjust and use the T&E mechanism, how to aim the sights of the weapon, proper breathing technique and proper trigger squeeze prior to any engagement practice with the weapon.

3. Preloading procedures have been conducted.

Task:

1. Load MK19
    - a. Open cover and insert first round of ammo (female link first)
    - b. Push round across the secondary feed pawl
    - c. Close cover

2. Charge MK19
    - a. Grasp the charger handles (both sides) with the palms facing down.
    - b. Press the charger handle locks in, rotate the handles down and pull them sharply to the rear
    - c. Return the charger handles forward to their original upright position after locking the bolt to the rear
    - d. Place safety selector switch on fire and press trigger
    - e. Repeat step b
    - f. Place safety selector switch to safe
    - g. Repeat c

3. Aim MK19 at designated targets
    a. Determine range to target
    b. Adjust rear sight as necessary
    c. Check or adjust the T&E mechanism as necessary
    d. Align front and rear sights with target

4. Engage targets using 3–5 round burst
    a. Grasp handles on back plate assembly
    b. Press butterfly trigger assembly downwards with thumbs

5. Adjust fire based on strike of rounds
    a. See target hit or go down
        (1) Cease fire
        (2) Move to next target and repeat steps 3–5 until all targets are engaged
    b. See impact of round off target
        (1) Cease fire
        (2) Adjust rear sight or T&E appropriately
        (3)Repeat steps 3-5 until all targets are engaged

6. Unload MK19
    a. Move safety selector switch to Safe
    b. Open top cover assembly
    c. Lock the bolt to the rear
    d. Remove the ammunition from the feed tray and throat

7. Clear MK19
    a. Firing Situation
        (1) Insert a section of cleaning rod or a bayonet through either side of the receiver rail
        (2) Close to the bolt face
        (3) Push down on any live cartridge ejecting it
        (4) Lower and pull charging handles to the rear
        (5) Inspect the chamber for rounds
        (6) Place safety selector switch to Fire
        (7) Maintaining rearward pressure on the charging handles press trigger and ease bolt forward
        (8) Place safety selector switch to Safe

    b. Non-Firing Situation
        (1) Place safety selector switch on Safe
        (2) Open top cover assembly
        (3) Lower one or both charger handles
        (4) Pull charger handle slightly to the rear

(5) Inspect chamber for rounds
(6) Ride bolt forward and charging handles to upright position

Post-conditions: Targets engaged IAW DA FORM 7518-R; Weapon cleared IAW FM 3-22.27

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Overall Score Computed: 5+5+4+4+4+5+4 = 31/7 = 4.43

<table>
<tr><td colspan="3">Real World (RW) Preconditions: Trainees have received training and have passed the MK19 fundamental skills test; Trainees have received training on how to install, adjust and use the T&E mechanism, how to aim the sights of the weapon, proper breathing technique and proper trigger squeeze prior to any engagement practice with the weapon; Preloading procedures have been conducted.</td><td colspan="3">Environmental Evaluation
1. Replication of environmental effects not possible outside of visual replication on screen of wind or low light conditions. This affordance was deemed not present.
2. The evaluation of the environment took into account the possibility that the weapon is used in both a crew served as well as individual capacity.
3. T&E mechanism not available at the sight of the evaluation. System administrator confirmed that the training system T&E is the same as the real weapon T&E. This feature was not used in calculating the evaluation score for the subtask items.
4. Clearance procedures for the non-firing condition may be fully practiced but step ii of the firing condition cannot be met because the simulator does not allow for round ejection.</td></tr>
<tr><th>RW Tasks</th><th>RW Human Abilities</th><th>RW Affordance Requirements</th><th>Environment HA</th><th>Environmental Affordances</th><th>Level of Support to Training</th></tr>
<tr><td>Load MK19
a. Open cover and insert first round of ammo (female link first)
b. Push round across the secondary feed pawl
c. Close cover</td><td><u>COGNITIVE:</u>
Problem Sensitivity; Spatial Orientation; Memorization; Selective Attention

<u>SENSORY:</u>
Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Near Vision

<u>PSYCHOMOTOR:</u>
Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination;

<u>PHYSICAL:</u></td><td>– Weapon resemblance with a receiver, bolt, working cover and cover latch
– Ammunition belt with a resemblance of ammunition and female and male links
– A resemblance of the feed pawls located in the proper locations as on the real weapon
– Ambient or other lighting that allows the viewing of the feed pawls for loading
– Training space where weapon resemblance and ammunition are available
– A stand or mount that</td><td><u>COGNITIVE:</u>
Problem Sensitivity; Information Ordering; Spatial Orientation; Perceptual Speed; Memorization;

<u>SENSORY:</u>
Night Vision; Peripheral Vision; Depth Perception; Near Vision;

<u>PSYCHOMOTOR:</u>
Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination;

<u>PHYSICAL:</u></td><td>– All Present</td><td>*5 – Excellent
4 – Very Good
3 – Good
2 – Fair
1 – Poor</td></tr>
</table>

	Extent Flexibility	holds the weapon resemblance in a proper position for loading, unloading firing and clearing activities	Static Strength; Extent Flexibility		
Charge MK19 a. Grasp the charger handles (both sides) with the palms facing down b. Press the charger handle locks in, rotate the handles down and pull them sharply to the rear c. Return the charger handles forward to their original upright position after locking the bolt to the rear d. Place safety selector switch on fire and press trigger e. Repeat step b f. Place safety selector switch to safe g. Repeat c	**COGNITIVE:** Problem Sensitivity; Information Ordering; Spatial Orientation; Memorization **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Near Vision **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination **PHYSICAL:** Static Strength; Trunk Strength; Extent Flexibility	– Weapon resemblance that is an appropriate weight with 2 charging handles one on either side of the weapon receiver – Charging handles provide haptic and proprioceptive feedback and range of motion similar to those of the MK19 – Weapon bolt resemblance that moves within the receiver resemblance that can be locked to the rear of the receiver – Resemblance of a Fire/Safe lever on the backplate of the weapon resemblance that provides haptic, proprioceptive and visual feedback of location (setting) – A stand or mount that holds the weapon resemblance in a proper position for loading, unloading,	**COGNITIVE:** Oral Expression; Oral Comprehension; Problem Sensitivity; Information Ordering; Spatial Orientation; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Near Vision; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Static Strength; Trunk Strength; Extent Flexibility;	– All Present	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

		firing and clearing activities – A butterfly type trigger resemblance located between two handles on the weapon receiver resemblance backplate			
Aim MK19 at designated targets a. Determine range to target b. Adjust rear sight as necessary c. Check or adjust the T&E mechanism as necessary d. Align front and rear sights with target	**COGNITIVE:** Problem Sensitivity; Spatial Orientation; Perceptual Speed; Memorization; Time Sharing; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Multilimb Coordination; Reaction Time **PHYSICAL:** None	– A stand or mount that holds the weapon resemblance in a proper position for loading, unloading, firing and clearing activities that is movable and adjustable – Targets that resemble enemy vehicles or personnel that are engageable (i.e., within range and viewable). – Targets must afford range estimation activity – Adjustable rear sight for range estimation – Traversing and Elevation mechanism – Front sight resemblance – Adequate lighting to see targets and sights – 2 vertical handles	**COGNITIVE:** Oral Expression; Oral Comprehension; Inductive Reasoning; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Multilimb Coordination; Reaction Time	– Tripod present for weapon mounting – Targets IAW 7518-R – Targets allow for range estimation – Rear sight is fully adjustable – T&E mechanism not available for this evaluation – Front Sight available – Adequate lighting present – Handles present – No replication of environmental effects	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

		located on the back of the weapon resemblance that allow it to be horizontally and vertically manipulated – Replication of environmental weather concerns or attributes (e.g., heat waves, cold, rain, wind effects)	**PHYSICAL:** None		
Engage targets using 3-5 round burst a. Grasp handles on back plate assembly b. Press butterfly trigger assembly downwards with thumbs	**COGNITIVE:** Number Facility; Spatial Orientation; Perceptual Speed; Memorization **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Rate Control; Multilimb Coordination; Reaction Time; **PHYSICAL:** Dynamic Strength; Trunk Strength;	– Haptic and proprioceptive feedback (recoil) similar to that of the real weapon that provides feedback on the number of rounds that have been fired – 2 vertical handles located on the back of the weapon resemblance that allow it to be horizontally and vertically manipulated – A butterfly type trigger resemblance located between the two vertical handles on the back of the weapon resemblance – Appropriate light for seeing targets and sights – Auditory feedback	**COGNITIVE:** Number Facility; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Rate Control; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Dynamic Strength;	– Haptic and proprioceptive feedback of recoil very similar to real weapon and adjustable – Vertical handles present – Butterfly trigger present – Appropriate light for seeing targets and sights available – Auditory feedback (noise) from weapon resemblance firing and functioning present – No Replication of environmental weather concerns or attributes (e.g., heat waves, cold, rain, wind effects)	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Stamina; Extent Flexibility;	(noise) from weapon resemblance firing and functioning – Replication of environmental weather concerns or attributes (e.g., heat waves, cold, rain, wind effects)	Trunk Strength; Stamina; Extent Flexibility		
Adjust fire based on strike of rounds a. See target hit or go down i. Cease fire ii. Move to next target and repeat steps 3-5 until all targets are engaged b. See impact of round off target i. Cease fire ii. Adjust rear sight or T&E appropriately iii. Repeat steps 3-5 until all targets are engaged	**COGNITIVE:** Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Memorization; Selective Attention; Time Sharing **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Hearing Sensitivity **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Rate Control; Multilimb Coordination; Wrist-Finger Speed; Reaction Time; **PHYSICAL:**	– Visual feedback of target status (e.g., target goes down, explodes, stops; kicked up dirt) – Auditory feedback (noise) from weapon resemblance firing and functioning – Recoil from weapon firing – A way to traverse and elevate the weapon resemblance – Replication of environmental weather concerns or attributes (e.g., heat waves, cold, rain, wind effects) – Adjustable rear sight for range estimation – Front sight resemblance	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; Reaction Time;	– Target obscuration is not an available feature during qualification tables. Obscuration is possible when shooting other scenarios. Disturbed dirt does dissipate. – Targets went down when struck with rounds. – Recoil of weapon adjustable and appropriate – Noise from weapon firing adjustable and appropriate – Front and rear sights present – It is possible to traverse and elevate the weapon. – No physical replication of weather effects	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Dynamic Strength; Trunk Strength; Stamina; Extent Flexibility;		**PHYSICAL:** Dynamic Strength; Extent Flexibility;		
Unload MK19 a. Move safety selector switch to Safe b. Open top cover assembly c. Lock the bolt to the rear d. Remove the ammunition from the feed tray and throat	**COGNITIVE:** Problem Sensitivity; Spatial Orientation; Memorization; Selective Attention **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Near Vision **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination **PHYSICAL:** Static Strength; Trunk Strength; Extent Flexibility	– Weapon resemblance with working cover and cover latch – Ammunition belt with resemblance of ammunition and female and male links – A resemblance of the feed pawls located in the proper locations as on the real weapon – Ambient or other lighting that allows the viewing of the feed pawls for loading – Training space where weapon resemblance and ammunition are available – Weapon resemblance that is the appropriate weight with 2 charging handles one on either side of the weapon receiver – Charging handles provide the correct haptic and proprioceptive feedback and range of motion as those of a MK19	**COGNITIVE:** Oral Expression; Oral Comprehension; Problem Sensitivity; Information Ordering; Spatial Orientation; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Far Vision; Near Vision; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Static Strength; Extent Flexibility;	– All Present	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

		– Weapon bolt resemblance that moves within the receiver resemblance that can be locked to the rear of the receiver – Resemblance of a Fire/Safe lever on the backplate of the weapon resemblance that provided haptic, proprioceptive and visual feedback of location (setting)			
Clear MK19 a. Firing Situation i. Insert a section of cleaning rod or a bayonet through either side of the receiver rail close to the bolt face ii. Push down on any live cartridge ejecting it iii. Lower and pull charging handles to the rear iv. Inspect the chamber for rounds v. Place safety selector switch to Fire	**COGNITIVE:** Problem Sensitivity; Spatial Orientation; Memorization; Selective Attention; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Near Vision **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination **PHYSICAL:** Static Strength; Trunk Strength; Extent Flexibility	– Resemblance of weapon receiver with handles, bolt mechanism and cover that function similarly to the real weapons bolt, receiver and cover – Resemblance of an ammunition belt and rounds that fit properly into the weapon resemblance receiver. – Receiver allows the ammunition resemblance to be ejected in the manner described – Charging handles that provide similar haptic and proprioceptive feedback and range of	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Spatial Orientation; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; Auditory Attention; Speech Recognition; **PSYCHOMOTOR:** Arm-Hand Steadiness;	– Weapon receiver appropriate – Ammo belt present – Rounds cannot be ejected as described in step ii. No ejecting of rounds is possible with the simulator. – Charging handles present and appropriate – Lighting appropriate – Fire/Safe Lever present – Triggers present – Cleaning rod/Bayonet not present as firing condition for clearing is not possible	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

vi. Maintaining rearward pressure on the charging handles press trigger and ease bolt forward vii. Place safety selector switch to Safe. b. Non-Firing Situation i. Place safety selector switch on Safe ii. Open top cover assembly iii. Lower one or both charger handles iv. Pull charger handle slightly to the rear v. Inspect chamber for rounds vi. Ride bolt forward and charging handles to upright position		motion to that of the real weapon – Ambient lighting that allows for the chamber to be viewed and rounds detected – Resemblance of a cleaning rod or bayonet that is insertable into the receiver of the weapon resemblance – Resemblance of a Fire/Safe lever on the backplate of the weapon resemblance that provided haptic, proprioceptive and visual feedback of location (setting) – Butterfly type trigger located between the handles on the backplate	Manual Dexterity; Finger Dexterity; Multilimb Coordination; Reaction Time; **PHYSICAL:** Static Strength; Trunk Strength; Extent Flexibility;		
Post-conditions: Targets engaged IAW DA FORM 7518-R; Weapon cleared IAW FM 3-22.27					

Score: 4.00 Very Good

High level Task: Engage targets with the M2 HB MG IAW DA Form 7449-R

Doctrine: FM 3-22.65, DA Form 7449-R

Preconditions:

1. Trainees have received training and have passed the M2 HB MG fundamental skills test (i.e., clearing the machine gun, disassembly and assembly of the machine gun, functions check, how to maintain the machine gun, set the headspace and timing, load the machine gun, perform immediate actions and unload the machine gun).

2. Trainees have received training on how to install, adjust and use the T&E mechanism, how to aim the sights of the weapon, proper breathing technique and proper trigger squeeze prior to any engagement practice with the weapon.

Tasks:

1. Load M2
    - a. Open machine gun cover and insert ammo belt
    - b. Close cover
    - c. Pull retracting handle to the rear locking the bolt in the rear position
    - d. Release handle

2. Charge M2
    - a. Pull charging handle to the rear of the weapon

3. Aim M2 at designated targets
    - a. Determine range to target
    - b. Adjust or check adjustment of T&E mechanism
    - c. Align front and rear sights with target

4. Engage targets using 5-7 round burst
    - a. Grasp handles on back plate
    - b. Press butterfly trigger assembly with thumbs

5. Adjust fire based on strike of rounds
    - a. See target hit or go down
        - (1) Cease fire
        - (2) Move to next target and repeat steps 3-5 until all targets are engaged
    - b. See impact of round off target
        - (1) Adjust rear sight and T&E appropriately
        - (2) Repeat steps 3-5 until all targets are engaged

6. Unload Weapon
    - a. Ensure weapon is in single shot mode

b. Lift machine gun cover
c. Remove ammo belt
d. Lock bolt to the rear of receiver

7. Clear Weapon
a. With bolt locked to the rear examine chamber and T-Slot for rounds
b. Insert cleaning rod into muzzle end of barrel and push to bore until visible
c. Remove cleaning rod from barrel
d. Press trigger

Post-conditions: Targets engaged per DA Form 7449-R; Engagements completed

DEFINITION OF SCALE

5–Excellent – the ITE contains all but a few (90–100%) of the affordances determined during the analysis
4–Very Good – the ITE contains a significant portion (70–89%) of the affordances determined during the analysis
3–Good – the ITE contains a good portion (50–69%) of the affordances determined during the analysis
2–Fair – the ITE contains some (25–49%) of the affordances determined during the analysis
1–Poor – the ITE contains very few (0–24%) of the affordances determined during the analysis

Result: Overall Score 4 (4+4+4+4+4+5+3) = 28/7 = 4

Real World (RW) Preconditions:			Environmental Evaluation		
Real World (RW) Preconditions: Trainees have received training and have passed the M2 HB MG fundamental skills test; Trainees have received training on how to install, adjust and use the T&E mechanism, how to aim the sights of the weapon, proper breathing technique and proper trigger squeeze prior to any engagement practice with the weapon.			**Environmental Evaluation** 1. Replication of environmental effects not possible outside of visual replication on screen of wind or low light conditions. This affordance was deemed not present. 2. The evaluation of the environment took into account the possibility that the weapon is used in both a crew served as well as individual capacity. 3. T&E mechanism not available at the sight of the evaluation. System administrator confirmed that the training system T&E is the same as the real weapon T&E. This feature was not used in calculating the evaluation score for the subtask items.		
RW Tasks	**RW Human Abilities**	**RW Affordance Requirements**	**Environment HA**	**Environmental Affordances**	**Level of Support to Training**
Load M2 a. Open machine gun cover and insert ammo belt b. Close cover c. Pull retracting handle to the rear locking the bolt in the rear position d. Release handle	**COGNITIVE:** Problem Sensitivity; Information Ordering; Spatial Orientation Perceptual Speed; Memorization **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Near Vision; Hearing Sensitivity **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Static Strength; Extent Flexibility	– Resemblance of M2 upper receiver with a cover that may be opened by turning a releasing lever on the left side of the cover; an ammunition feedway with belt-holding pawls that afford the ammunition belt to be held in place and extractor – A resemblance of an ammunition belt with double and single loop ammo links – A handle on the right side of the M2 resemblance that may be grasped and moves horizontally from front to rear and back to front that provides haptic feedback (pressure and force)	**COGNITIVE:** Problem Sensitivity; Information Ordering; Spatial Orientation; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Near Vision; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Static Strength; Extent Flexibility;	– Demilitarized .50 caliber machine gun with working upper receiver, bolt and cover. – Training ammunition with male and female linkage – No feed pawls to catch ammunition belt or extractor present. Rounds stayed in place without pawls or extractor. – Handle on right side of M2 that moved and provided proper haptic feedback	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

		similar to that of the real weapon – Resemblance of bolt action moving from front to rear of weapon when handle engaged			
Charge M2 a. Pull charging handle to the rear of the weapon	**COGNITIVE:** Information Ordering; Spatial Orientation; Memorization **SENSORY:** Night Vision; Glare Sensitivity; Depth Perception; Near Vision **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Static Strength; Extent Flexibility	– M2 upper receiver resemblance with backplate handles that may be grasped with one or both hands – A handle on the right side of the M2 resemblance that moves back and forth that provides haptic feedback (pressure and force) similar to that of the real weapon – Haptic resemblance of the bolt action moving within the weapon when the handle is engaged – Ability to visually detect the ejection of ammunition links, casings or rounds from the right side of the ammunition feedway of the device when the device is charged	**COGNITIVE:** Information Ordering; Spatial Orientation; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Near Vision; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Static Strength; Extent Flexibility;	– Receiver present with backplate handles – Handle on right side of M2 that functioned as on the real weapon with proper haptic feedback – Bolt action in receiver accurate and appropriate – No spent ammunition or links are ejected when the weapon is charged or fired.	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor
Aim M2 at designated targets a. Determine range to target	**COGNITIVE:** Information Ordering; Spatial Orientation; Perceptual Speed; Memorization	– M2 resemblance with backplate handles that may be grasped with one or both hands and moved so that it can	**COGNITIVE:** Oral Expression; Oral Comprehension; Inductive Reasoning; Problem Sensitivity;	– M2 resemblance with backplate handles graspable with both hands	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

b. Adjust or check adjustment of T&E mechanism c. Align front and rear sights with target	**SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Multilimb Coordination Reaction Time **PHYSICAL:** None	be aligned with the target – Rear peep site and front sight blade that resemble those found on the M2 – The rear sight assembly is adjustable for range estimation – Targets designed and displayed IAW DA Form 7449-R that are recognizable and visible to the trainee – A way to traverse and elevate the weapon resemblance – Tripod or mount for weapon resemblance to be mounted on – Replication of environmental weather concerns or attributes (e.g., heat waves, cold, rain, wind effects)	Information Ordering; Spatial Orientation; Flexibility of Closure; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Control Precision; Multilimb Coordination; Reaction Time; **PHYSICAL:** None	– Rear peep site and front sight blade – Rear sight assembly is adjustable for range estimation – Targets are displayed and designed IAW DA Form 7449-R and are recognizable and visible – Evaluated system was on a tripod, which allowed for traversing and elevation of the weapon – Tripod present – Display of some environmental effects conditions such as fog, night and wind were possible with the EST computer. No replication of actual weather is possible in the building used for training.	
Engage targets using 5-7 round burst a. Grasp handles on back plate b. Press butterfly trigger assembly with thumbs	**COGNITIVE:** Information Ordering; Memorization **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual	– Trigger that affords engagement with thumbs and haptic feedback to trainee when thumb pressure is applied – Handles that afford grasping vertically – Recoil from weapon	**COGNITIVE:** Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Memorization; **SENSORY:** Night Vision; Peripheral Vision;	– Proper trigger assembly present – Handles present – Recoil adjustable and appropriate – Noise adjustable and appropriate – Visual obscuration effects were minimal	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Color Discrimination **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination **PHYSICAL:** Dynamic Strength; Trunk Strength; Stamina; Extent Flexibility	firing – Noise from weapon firing – Obscuration from weapon firing (e.g., smoke, dirt) – Sound delineating individual rounds firing so that 5-7 round bursts may be identified by firer – Replication of environmental weather concerns or attributes (e.g., heat waves, cold, rain, wind effects)	Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Dynamic Strength; Trunk Strength; Stamina; Extent Flexibility	(e.g., dirt from strike of round) – Sound of firing seemed slightly fast but appropriate – No physical replication of environmental effects only visual	
Adjust fire based on strike of rounds a. See target go down i. Cease fire ii. Move to next target and repeat #5 b. See impact of round off target i. Adjust elevation, range or horizontal position ii. Repeat #5	**COGNITIVE:** Inductive Reasoning; Problem Sensitivity; Spatial Orientation; Speed of Closure; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness;	– Dissipation of target obscuration (e.g., smoke, dirt) – Visual feedback that target has been struck (i.e., bullet hole, target falling, dirt kicked up near target) – Replication of environmental weather concerns or attributes (e.g., heat waves, cold, rain, wind effects) – Recoil from weapon firing – Noise from weapon firing – A way to traverse and	**COGNITIVE:** Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Spatial Orientation; Flexibility of Closure; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Far Vision; Near Vision; Visual Color	– Target obscuration is not an available feature during qualification tables. Obscuration is possible when shooting other scenarios. Disturbed dirt does dissipate. – Targets went down when struck with rounds. – No physical replication of weather effects – Recoil of weapon adjustable – Noise from weapon	5 – Excellent *4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Manual Dexterity; Finger Dexterity; Multilimb Coordination; Reaction Time; **PHYSICAL:** Dynamic Strength; Extent Flexibility	elevate the weapon resemblance	Discrimination; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; Reaction Time **PHYSICAL:** Dynamic Strength; Extent Flexibility;	firing adjustable – It is possible to traverse and elevate the weapon.	
Unload Weapon a. Ensure weapon is in single shot mode b. Lift machine gun cover c. Remove ammo belt d. Lock bolt to the rear of receiver	**COGNITIVE:** Problem Sensitivity; Information Ordering; Spatial Orientation; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Near Vision; Hearing Sensitivity **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Static Strength; Extent	– Resemblance of M2 upper receiver with a cover that may be opened by turning a releasing lever on the left side of the cover; an ammunition feedway with belt-holding pawls that afford the ammunition belt to be held in place – A resemblance of an ammunition belt with double and single loop ammo links – A handle on the right side of the M2 resemblance that may be grasped and moves horizontally from front to rear and back to front that provides haptic feedback (pressure and force)	**COGNITIVE:** Oral Expression; Oral Comprehension; Problem Sensitivity; Information Ordering; Spatial Orientation; Perceptual Speed; Memorization; **SENSORY:** Night Vision; Peripheral Vision; Depth Perception; Far Vision; Near Vision; **PSYCHOMOTOR:** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **PHYSICAL:** Static Strength; Extent	– Resemblance of M2 upper receiver with a cover that may be opened by turning a releasing lever on the left side of the cover; an ammunition feedway with belt-holding pawls that afford the ammunition belt to be held in place – A resemblance of an ammunition belt with double and single loop ammo links – A handle on the right side of the M2 resemblance that may be grasped and moves horizontally from front to rear and back to front that provides haptic feedback (pressure and force)	*5 – Excellent 4 – Very Good 3 – Good 2 – Fair 1 – Poor

	Flexibility	similar to that of the real weapon – Resemblance of bolt action moving from front to rear of weapon when handle engaged	Flexibility;	similar to that of the real weapon – Resemblance of bolt action moving from front to rear of weapon when handle engaged	
Clear Weapon a. With bolt locked to the rear examine chamber and T-Slot for rounds b. Insert cleaning rod into muzzle end of barrel and push to bore until visible c. Remove cleaning rod from barrel d. Press trigger	**<u>COGNITIVE:</u>** Inductive Reasoning; Problem Sensitivity; Information Ordering; Spatial Orientation; Perceptual Speed; Memorization **<u>SENSORY:</u>** Night Vision; Peripheral Vision; Glare Sensitivity; Depth Perception; Near Vision; **<u>PSYCHOMOTOR:</u>** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **<u>PHYSICAL:</u>** Extent Flexibility	– Resemblance of M2 upper receiver with a cover that may be opened by turning a releasing lever on the left side of the cover – Resemblance of T-Slot – Barrel that a cleaning rod may be inserted into from the tip to the bore to “clear” the weapon. – Cleaning rod – Trigger that affords engagement with thumbs and haptic feedback to trainee when thumb pressure is applied – Wooden block to insert inside T-Slot once weapon is deemed clear	**<u>COGNITIVE:</u>** Oral Expression; Oral Comprehension; Deductive Reasoning; Inductive Reasoning; Problem Sensitivity; Information Ordering; Spatial Orientation;; Perceptual Speed; Memorization; **<u>SENSORY:</u>** Night Vision; Peripheral Vision; Depth Perception; Far Vision; Near Vision; Visual Color Discrimination; **<u>PSYCHOMOTOR:</u>** Arm-Hand Steadiness; Manual Dexterity; Finger Dexterity; Multilimb Coordination; **<u>PHYSICAL:</u>** Extent Flexibility	– Resemblance of M2 upper receiver with a cover that may be opened by turning a releasing lever on the left side of the cover – Resemblance of T-Slot – Barrel is solid and contains laser for EST. Not possible to insert cleaning rod – Trigger that affords engagement with thumbs and haptic feedback to trainee when thumb pressure is applied – No block present since weapon cannot be cleared IAW FM 3.22.65 – No cleaning rod present during this evaluation	5 – Excellent 4 – Very Good *3 – Good 2 – Fair 1 – Poor
Post-conditions: Targets engaged per DA Form 7449-R; Engagements completed.					

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LIST OF REFERENCES

Annett, J. (2004). Hierarchial task analysis. In D. Diaper & S. Neville (Eds.), *The handbook of task analysis for human-computer interaction* (pp. 67–82). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Azadeh, A., Shirkouhi, S., & Rezaie, K. (2010). A robust decision-making methodology for evaluating simulation software package. *International Journal, Advanced Manufacturing Technology, 47*, 381–393. doi: 10.1007/s00170-009-2205-6

Azadeh, M., & Shirkouhi, S. (1995). Evaluating simulation software using fuzzy analytical hierarchy process. In *Proceedings of the 2009 Spring Simulation Multiconference*. San Diego: Society for Computer Simulation International.

Bærentsen, K., & Trettvik, J. (2002). An activity theory approach to affordance. In *Proceedings of the Second Nordic Conference of Human Computer Interaction* (pp. 51–60). New York: Association for Computing Machinery.

Baldwin, T., & Ford, J. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology, 41*, 63–105. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1744-6570.1988.tb00632.x/abstract

Banks, J. (1991). Selecting simulation software. In *Proceedings of the 1991 Winter Simulation Conference* (pp. 15–20). Phoenix, AZ: IEEE Computer Society Press.

Beal, S., & Christ, R. (2004). *Training effectiveness evaluation of the full spectrum command game* (TR 1140). FT Benning: U.S. Army Research Institute for the Behavioral and Social Sciences.

Biron, L. (2012, September 12). Army's immersive training system finally rolls out. *Defense News*. Retrieved from http://www.defensenews.com/article/20120806/TSJ01/308060003/Army-8217-s-Immersive-Training-System-Finally-Rolls-Out

Bloom, R., & Yanko, D. (1986). Use of job task analysis to determine training requirements. In *Proceedings of the Human Factors Society—30th Annual Meeting*, Dayton, OH.

Blume, B., Ford, J., Baldwin, T., & Huang, J. (2009). Transfer of training: A meta-analytic review. *Journal of Management, 36*, 1065–1105.

Burnside, B. (1990). *Assessing the capabilities of training simulations: A method and simulation networking (SIMNET) application* (RR 1565). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Carter, R. J. (1982). Methodologies for evaluating training products and processes. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *26*, 258–262.

Chemero, A. (2003). An outline of a theory of affordances. *Ecological Psychology*, *15*, 181–195. doi:10.1207/S15326969ECO1502_5

Chemero, A., & Turvey, M. (2007). Gibsonian affordances for roboticists. *Adaptive Behavior*, *15*, 473–480. doi:10.1177/1059712307085098

Cochran, J., & Chen, H. (2005). Fuzzy multi-criteria selection of object-oriented simulation software for production system analysis. *Computers & Operations Research*, *32*, 153–168. doi:10.1016/S0305-0548(03)00209-0

Cockayne, W. (1998). *Two-handed, whole-hand interaction* (Masters thesis, Naval Postgraduate School). Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA356098

Cockayne, William., & Darken, R. (2004). The application of human ability requirements to virtual environment interface design and evaluation. In D. Diaper & S. Neville (Eds.), *The handbook of task analysis for human—computer interaction* (pp. 401–421). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Cream, B., Eggemeier, F., & Klein, G. (1975). Behavioral data in the design of aircrew training devices. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *19*, 260–265.

Crystal, A., & Ellington, B. (2004). Task analysis and human-computer interaction: approaches, techniques, and levels of analysis. In *Proceedings of the Tenth Americas Conference on Information Systems* (pp. 1–9), New York.

Darken, R. (2009). Identifying the limits of training system effectiveness through taxonomies of human performance. *Theoretical Issues in Ergonomics Science*, *10*, 231–243. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/14639220802151625

Davis, L., & Williams, G. (1994). Evaluating and selecting simulation software using the analytic hierarchy process. *Integrated Manufacturing Systems*, *5*, 23–32. Retrieved from http://www.emeraldinsight.com/journals.htm?articleid=850618&show=abstract

Dawdy, E. D., & Hawley, J. K. (1982). A forecasting method for training effectiveness analysis. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *26*, 250–254.

Deaver, R. (1987). Selecting a manufacturing simulation system. *CIM Review, 3*, 6–8. Retrieved from http://dl.acm.org/citation.cfm?id=26453

Department of the Army. (2011). *Training units and developing leaders for full spectrum operations* (FM 7-0). Washington, DC: Author.

Department of Defense. (2001). *Department of defense handbook, instructional systems development/systems approach to training and education* (MIL-HDBK-29612-2A, Part 2 of 5 parts). Washington, DC: Author.

Drillings, M. (2013, Summertime). Director's corner. *MANPRINT*. Retrieved from http://www.manprint.army.mil

Durrani, S., Geiger, C., Jones, D., Hale, K., & Street, E. (2008). An approach for assessing training effectiveness in virtual reality environments. In *Proceedings of the 2008 Industrial Engineering Research Conference* (pp. 452–457). United States: Institute of Industrial Engineers.

Ericsson, K. A. (2006). An introduction to cambridge handbook of expertise and expert performance: Its development, organization, and content. In K. Ericsson, N. Charness, P. Feltovich, & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 3–20). Cambridge: Cambridge University Press.

Ericsson, K., Charness, N., Feltovich, P., & Hoffman, R. (Eds.). (2006). *The Cambridge handbook of expertise and expert performance*. Cambridge, MA: Cambridge University Press.

Feinstein, A., & Cannon, H. (2002). Constructs of simulation evaluation. *Simulation & Gaming*, *33*, 425–440. doi:10.1177/1046878102238606

Fleishman, E., & Mumford, M. (1991). Evaluating classifications of job behavior: A construct validation of the ability requirement scales. *Personnel Psychology*, *44*, 523–575. doi:10.1111/j.1744-6570.1991.tb02403.x

Fleishman, E., & Quaintance, M. (1984). *Taxonomies of human performance: The description of human tasks*. Orlando, FL: Academic Press.

Fleishman, E., & Bartlett, C. (1969). Human abilities. *Annual Review of Psychology*, *20*, 349.

Ford, J., & Weissbein, D. (1997). Transfer of training: An updated review and analysis. *Performance Improvement Quarterly*, *10*, 22–41. Retrieved from http://www.performancexpress.org/wp-content/uploads/2011/11/Transfer-of-Training.pdf

Fossett, C., Harrison, D., Weintrob, H., Fossett, I., & Gass, S. (1991). An assessment procedure for simulation models : A case study. *Operations Research*, *39*, 710–723. Retrieved from http://www.jstor.org/stable/17201

Foster, C. (2009). The case for outcomes-based training and education. *Armor Magazine, 6*, 19–23.

Government Accounting Office. (2012). *Guidance and progress measures are needed to realize benefits from changes in DOD's joint requirements process* (GAO-12-399). Washington, DC: Author. Retrieved from http://www.gao.gov/search?q=GAO-12-339&Submit=Search

Government Accounting Office. (2013). *ARMY and MARINE CORPS training: Better performance and cost data needed to more fully assess simulation-based efforts* (GAO-13-698). Washington, DC: Author.

Gass, S., & Thompson, B. (1980). Guidelines for model evaluation: An abridged version of the US general accounting office exposure draft. *Operations Research*, *28*, 431–439. Retrieved from http://www.jstor.org/stable/10.2307/170460

Gibson, James. J. (1986). The theory of affordances. In *The ecological approach to visual perception* (pp. 127–143). Hillsdale: Lawrence Erlbaum Associates, Inc.

Gieskens, D., & Foley, J. (1991). Controlling user interface objects through pre- and postconditions. In *Proceedings of SIGCHI Conference on Human Factors in Computing Systems* (pp. 189–194). New York: Computer Human Interaction.

Gilligan, E., Elder, B., & Sticha, P. (1990). *Optimization of simulation-based training systems: User's guide* (RN 91-04). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Gorman, P. (1991). The Future of tactical engagement simulation. In *Proceedings of the 1991 Summer Computer Simulation Conference* (pp. 1–9), San Diego, CA.

Hays, R., & Singer, M. (1983). Research issues in training device design. In *Proceedings of the Human Factors Society 27th Annual Meeting* (pp. 147–150). Santa Monica, CA: Human Factor's Society.

Hays, R., & Singer, M. (1988). *Simulation fidelity in training system design: Bridging the gap between reality and training*. New York: Springer-Verlag.

Hlupic, V., & Mann, A. (1995). SimSelect: a system for simulation software selection. In *Proceedings of the 1995 Winter Simulation Conference* (pp. 720–727). Arlington, VA.

Hlupic, V., & Paul, R. (1995). A critical evaluation of four manufacturing simulators. *International Journal of Production Research, 33*, 37–41. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/00207549508904843

Hlupic, V., & Paul, R. (1996). Methodological approach to manufacturing simulation software selection. *Computer Integrated Manufacturing Systems*, *9*, 49–55. doi:10.1016/0951-5240(95)00037-2

Hodges, G., Darken, R., & McCauley, M. (2014). An analytical method for assessing the effectiveness of human in the loop simulation environments : A work in progress. In *Proceedings of the 2014 Spring Simulation Multi-conference*. Tampa, FL: The Society for Modeling and Simulation International.

Holder, K. (1990). Selecting simulation software: An approach to the problem of selecting software for a given modelling situation. *OR Insight*, *3,* 19–24.

Hollnagel, E. (2006). Task analysis : Why , what , and how. In G. Salvendy (Ed.), *Handbook of human factors and ergonomics* (pp. 373–383). Hoboken, NJ: Wiley.

Hubbard, D. (2009). *The failure of risk management: Why it's broken and how to fix it*. Hoboken, NJ: John Wiley & Sons.

Hughes, C., & Nau, K. (2008). *Engagement skills trainer (EST) 2000 heavy weapons training effectiveness analysis (TEA)* (TR 08-025). White Sands Missile Range, NM: TRADOC Analysis Center.

Jacobs, R., Crooks, W., Crooks, J., Colburn, E., Fraser, R., Gorman, F., Madden, J.,…& Tice, S. (1994). *Training dismounted soldiers in virtual environments : Task and research requirements* (TR 1011). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Jadhav, A. S., & Sonar, R. M. (2009). Evaluating and selecting software packages: A review. *Information and Software Technology*, *51*, 555–563. doi:10.1016/j.infsof.2008.09.003

Jones, K. (Ed.). (2003a). How shall affordances be refined? Four perspectives: a special issue of ecological psychology. *Ecological Psychology ,13*. Mahwah, NJ: Psychology Press. Retrieved from http://www.routledge.com/books/details/9780805895933

Jones, K. (2003b). What is an affordance? *Ecological Psychology*, *15*, 107–114. doi:10.1207/S15326969ECO1502_1

Keesling, J., King, J., & Mullen, W. (1999). *Simulation training strategies for force XXI final technical report* (Report 2000-02). Alexandria: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA370982

Klein, G., Johns, P., Perez, R., & Mirabella, A. (1985). *Comparison-based prediction of cost and effectiveness of training devices: A guidebook* (Report 85-29). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA170941

Law, A., & Haider, S. (1989). Selecting simulation software for manufacturing applications. In *Proceedings of the 1989 Winter Simulations Conference* (pp. 29–32). Retrieved from http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=6686401

Levinson, E., & Donovan, M. (1984). Simulator fidelity specification based on training needs. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *28*, 142–146. doi:10.1177/154193128402800211

Lintern, G. (2000). An affordance-based perspective on human-machine interface design. *Ecological Psychology*, *12*, 65–69. doi:10.1207/S15326969ECO1201_7

Maitland, A (1982). Training effectiveness analysis: Where the operator meets the equipment. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *26*, 255–257. doi:10.1177/154193128202600316

Marks, C., Smead, K., & Alt, J. (2013). *Enhancing subject matter expert elicitation techniques* (TR 13-048). Monterey, CA: TRADOC Analysis Center.

Matlick, R., Berger, D., & Rosen, M. (1980). *Cost and training effectiveness analysis performance guide* (RP 81-1). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA101985

Michaels, C. (2003). Affordances: Four points of debate. *Ecological Psychology*, *15*, 135–148. doi:10.1207/S15326969ECO1502_3

Mieg, H. (2006). Social and sociological factors in the development of expertise. In K. A. Ericsson, N. Charness, P. J. Feltovich, & R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 743–760). Cambridge, MA: Cambridge University Press.

Milham, L., Carroll, M., Jones, D., Dean, S., & Chang, D. (2008). Cue fidelity evaluation : A requirements-driven approach to training effectiveness evaluation. In *Proceedings of the Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC)* (pp. 1–7). Orlando, FL: National Training and Simulation Association.

Milham, L., Carroll, M., Stanney, K., & Becker, W. (2003). Training systems requirements analysis. In D. Schmorrow, J. Cohn, & D. Nicholson (Eds.), *The PSI handbook of virtual environments for training and education* (pp. 165–192). London: Praeger Security International.

Montague, W. (1982). *Is simulation fidelity the question?* (TN 82-13). San Diego: Naval Personnel Research and Development Center. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA158065

Morrison, J., & Hammon, C. (2000). *On measuring the effectiveness of large-scale training simulations* (IDA-P-3570). Alexandria, VA: Institute for Defense Analysis.

Muckler, F., & Finley, D. (1994a). *Applying training system estimation models to army training. Volume 1. Analysis of the literature* (ARL-TR-463). Alexandria, VA. U.S. Army Research Institute. Retrieved from http://www.stormingmedia.us/12/1203/A120382.html

Muckler, F., & Finley, D. L. (1994b). *Applying training system estimation models to army training. Volume 2. An annotated bibliography 1970–1990* (ARL-TR-463). Alexandria, VA. U.S. Army Research Institute. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA283022

Muth, E., & Switzer, F. (2009). Training effectiveness and evaluation: Section perspective. In J. Cohn, D. Nicholoson, & D. Schmorrow (Eds.), *The PSI handbook of virtual environments for training and education* (pp. 147–155). London: Praeger Security International.

Napoletano, N. (2013). The eyes have it: Simulated sound visualization for testing. In *Proceedings of the Interservice/Industry Training, Simulation & Education Conference*. Orlando, FL: National Training and Simulation Association. Retrieved from http://www.iitsec.org/about/PublicationsProceedings/Pages/BestPapers.aspx

Neal, G. (1982). Overview of training effectiveness analysis. In *Proceedings of the Human Factors and Ergonomics Society 26th Annual Meeting* (pp. 244–248). doi:10.1177/154193128202600313

Neal, G., & Paris, T. (1985). The contribution of training effectiveness analysis in the Army. In *Proceedings of the Human Factors Society—29th Annual Meeting* (pp. 387–390). Retrieved from http://pro.sagepub.com/content/29/4/387.short

Nikoukaran, J., Hlupic, V., & Paul, R. (1998). Criteria for simulation software evaluation. In *Proceedings of the 30th conference on winter simulation* (pp. 399–406). Los Alamitos, CA: IEEE Computer Society Press. Retrieved from http://dl.acm.org/citation.cfm?id=293256

Nikoukaran, J., Hlupic, V., & Paul, R. (1999). A hierarchical framework for evaluating simulation software. *Simulation Practice and Theory*, *7*, 219–231. doi:10.1016/S0928-4869(98)00028-7

Nikoukaran, J., & Paul, R. (1999). Software selection for simulation in manufacturing: A review. *Simulation Practice and Theory*, *7*, 1–14. doi:10.1016/S0928-4869(98)00022-6

Nikoukaran, J., & Paul, R. J. (1998). Simulation packages whys and hows. *Yugoslav Journal of Operations Research*, *8*, 93–102. doi:0354-0243

Nolan, J. (2007). Avoid painting walls with a hammer: a methodology for leveraging COTS/GOTS games for military training. In *Proceedings of the 2007 Spring Simulation Multiconference Vol 3* (pp. 1–7). Retrieved from http://dl.acm.org/citation.cfm?id=1404858

Paolozzi, P. (2013). Closing the candor chasm: The missing element of Army professionalism. *Professional Military Ethics Monograph Series*, *5*, 1–40. Retrieved from http://kms2.isn.ethz.ch/serviceengine/Files/ESDP/169945/ipublicationdocument_singledocument/6f32c1c4-8845-4f71-b20d-7a1eac21cefd/en/pub1178.pdf

Patrick, J. (1992). *Training research & practice*. London: Academic Press.

Petty, M. (2009). Verification and validation. In J. Sokolowski & C. Banks (Eds.), *Principles of modeling and simulation: A multidisciplinary approach* (pp. 121–149). Hoboken, NJ: John Wiley & Sons.

Ratwani, K., Orvis, K., & Knerr, B. (2010). *Game-based training effectiveness evaluation in an operational setting* (SR 2010-02). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA530660

Rose, A., Martin, A., & Yates, L. (1985). *Forecasting device effectiveness : Volume III. analytic assessment of device effectiveness forecasting technique* (TR 681). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA160029

Rose, A., Wheaton, G., & Yates, L. (1985). *Forecasting device effectiveness : Volume I. issues* (TR 680). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved from http://www.stormingmedia.us/67/6759/A675951.html

Rome, E., Paletta, L., Sahin, E., Dorffner, G., Hertzberg, J., Breithaupt, R., Fritz, G.,...& Uğur, E. (2008). The MACS project: An approach to affordance-inspired robot control. In E. Rome, J. Hertzberg & G. Dorffner (Eds.) *Towards affordance-based robot control* (pp. 173– 210). Berlin: Springer

Salas, E., & Cannon-Bowers, J. (2001). The science of training: A decade of progress. *Annual Review of Psychology*, *52*, 471–499. Retrieved from http://www.annualreviews.org

Salas, E., Milham, L., & Bowers, C. (2003). Training evaluation in the military: Misconceptions, opportunities, and challenges. *Military Psychology*, *15,* 3–16. doi:10.1207/S15327876MP1501_01

Salas, E., Rosen, M., Held, J., & Weissmuller, J. (2008). Performance measurement in simulation-based training: A review and best practices. *Simulation & Gaming*, *40*, 328–376. doi:10.1177/1046878108326734

Sanders, M., & McCormick, E. (1993). *Human factors in engineering and design*. New York: McGraw-Hill.

Sargent, R. G. (2010). Verification and validation of simulation models. In *Proceedings of the 2010 Winter Simulation Conference* (pp. 166–183). Retrieved from http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=5429327

Schraagen, J. (2006). Task analysis. In K. Ericsson, N. Charness, P. Feltovich, & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 185–201). New York: Cambridge University Press.

Simpson, H. (1995). *Cost-effectiveness analysis of training in the department of defense.* (TR 95-004). Monterey, CA: Defense Manpower Data Center. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA302985

Simpson, H. (1999a). *Evaluating large-scale training simulations evaluating large-scale volume I : Reference manual*. Monterey, CA: Defense Manpower Data Center. Retrieved from http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA383851

Simpson, H. (1999b). *Evaluating large-scale training simulations volume II : User's manual*. Monterey, CA: Defense Manpower Data Center. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA383852

Smode, A., & Hall, E. (1975). Translating information requirements into training device fidelity requirements. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (pp. 33–36). doi:10.1177/154193127501900110

Sticha, P., Campbell, R., & Knerr, M. (2002). *Individual and collective training in live, virtual and constructive environments. Training concepts for virtual environments* (SR 2002-05). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA402315

Stoffregen, T. (2003). Affordances are enough: Reply to Chemero et al. (2003). *Ecological Psychology, 15*, 29–36.

Stoffregen, T. (2003). Affordances as properties of the animal-environment system. *Ecological Psychology, 15*, 115–134. doi:10.1207/S15326969ECO1502_2

Tewoldeberhan, T., Verbraeck, A., Valentin, E., & Bardonnet, G. (2002). An evaluation and selection methodology for discrete-event simulation software. In *Proceedings of the 2002 Winter Simulation Conference* (pp. 67–75). Retrieved from http://modelis.chez-alice.fr/DESMethodology.pdf

Thorndike, E. L. (1932). *The fundamentals of learning*. New York: Teachers College Bureau of Publications. doi:10.1037/10976-000

Training and Doctrine Command. (1994). *The TRADOC training effectiveness analysis (TEA) system*. Fort Monroe, VA: Author.

Training and Doctrine Command. (2011). *TRADOC regulation 71-20: Concept development, capabilities determination, and capabilities integration*. Fort Monroe, VA: Author.

Tufano, D., & Evans, R. (1982). *The prediction of training device effectiveness : A review of Army models* (TR 613). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA146937

Turvey, M. T. (1992). Affordances and prospective control: An outline of the ontology. *Ecological Psychology*, *4*, 173–187. Retrieved from http://www.tandfonline.com/doi/abs/10.1207/s15326969eco0403_3

Under Secretary of Defense (AT&L). (1998). DOD modeling and simulation (M&S) glossary (DOD 5000.59-M). Washington, DC: Author.

Under Secretary of Defense. (2009). Modeling and simulation (M&S) verification, validation, and accreditation (VV&A) instruction (DoD Instruction 5000-61). Washington, DC: Author. Retrieved from http://www.dtic.mil/whs/directives/corres/pdf/500061p.pdf

Vonguru, V. (1995). *Design enhancements for precondition-and postcondition-controlled user interfaces* (p. 180). Ruston: Louisiana Tech University. Retrieved from http://books.google.com/books/about/Design_Enhancements_for_Precondition_and.html?id=F89eNwAACAAJ

Wheaton, G., Rose, A., Fingerman, P., Korotkin, A., & Holding, D. (1976). *Evaluation of the effectiveness of training devices: Literature review and preliminary model* (RM 76-6). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA076809

Wickens, C., Lee, J., Liu, Y., & Becker, S. (2004). *An introduction to human factors engineering*. Upper Saddle River: Pearson Prentice Hall.

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